

NEW TECHNOLOGY JAPAN



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INNOVATIVE PRODUCTION NOW

Eco-Merit Particle Board Manufacturing Plant for Multi-Product/ Small-Lot Production
--Wakamatsu Plant of Particle Board Division, Dantani Corp.--

TOPICS

Japan's Largest 12,300-kW Cogeneration Plant Commissioned into Service
Injection Assembly Technology
--One Piece Injection Molding of Elastomers and Rigid Resins--

NATIONAL R&D PROJECTS

Life Cycle Assessment of Lithium Batteries

GENERIC TECHNOLOGY REVIEW

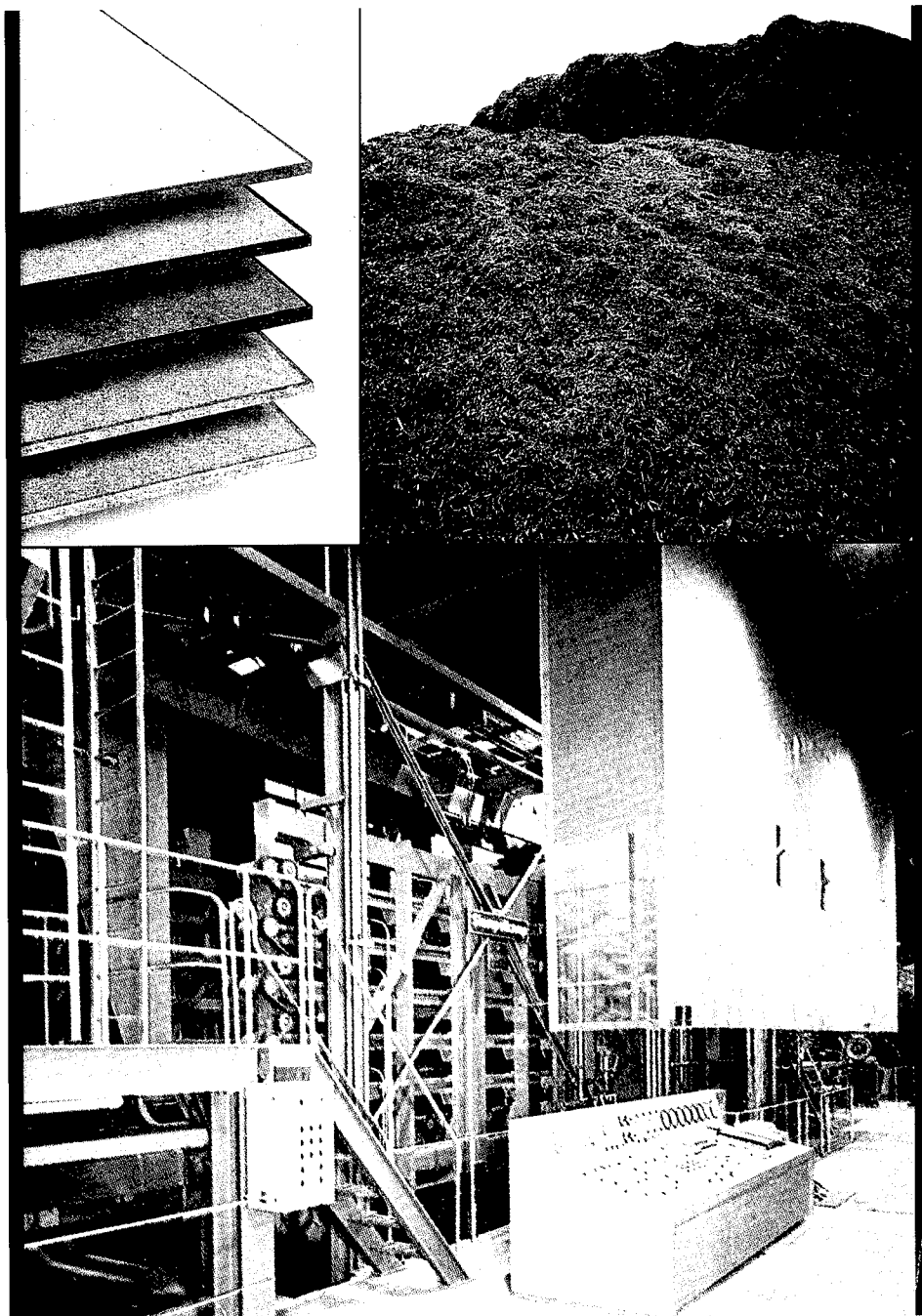
Elucidation of the Mechanism of Explosive Reaction of Hazardous Reactive Gases and Prevention of Explosion
Fabrication of New Materials with Assemblies of Polymers Containing Chelation Moiety and Their Application for Separation and Detection of Trace Metal Elements

HIGH-TECH INFORMATION

Stack Cell Technology for Futuristic DRAMs
Starting-Out Stage of Ram Accelerator Projectile Visualized
Technology for Plating Ferrite Film onto Ultrafine Plastic Spheres
System for Refining DNA Specimens Most Efficiently
Millimeter Wavelength Doppler Radar for Fog Observations

FLASH

Magnetic Band Decreases Pollutants in Exhaust Gases
High-Accuracy Light-powered Quartz Wristwatch Series

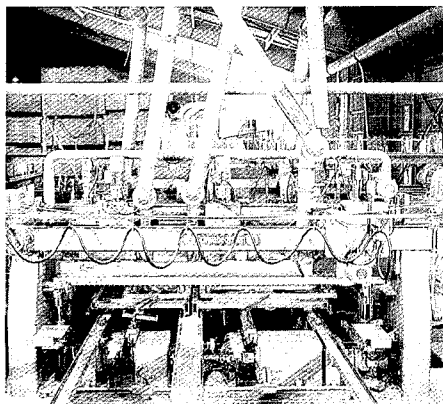


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Cover Photo;Eco-Merit Particle Board Manufacturing Plant for Multi-Product/ Small-Lot Production ;Dantani Corp.
;(Story on Pages 2-5)

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■ **High-Accuracy Light-powered Quartz Wrist-watch Series**

INNOVATIVE PRODUCTION NOW

This section describes a specialized section or whole process of a representative factory which excels in specific aspects of production.

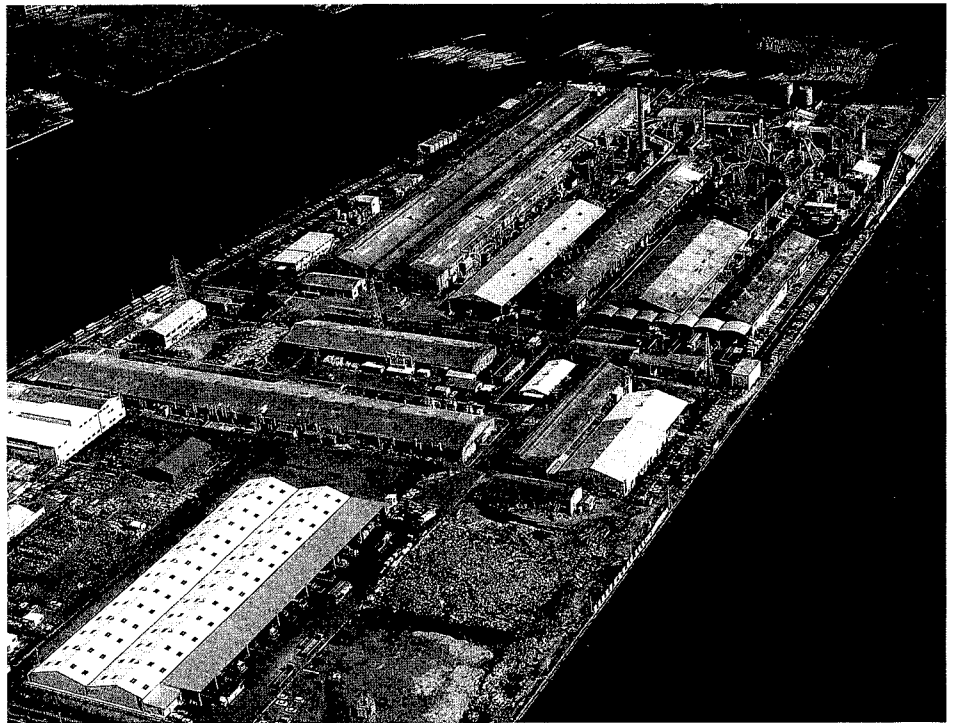
Eco-Merit Particle Board Manufacturing Plant for Multi-Product/Small-Lot Production

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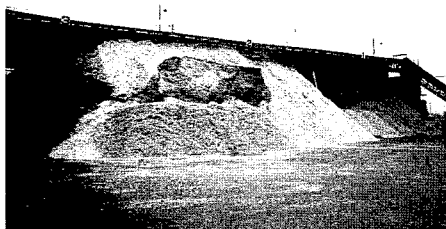
1. Introduction

The particle board is now a very important wooden raw material and is used widely in place of expensive plywood and other wooden structural materials to produce the top, side, front and shelf panels of furniture (Occidental and Oriental chests of drawers, footwear/diningware/book shelves, sideboards, school desks, ornamental shelves, living/dining room tables and counters, etc.), for producing cabinets (for kitchens, wash-bowls, stereo/audio equipment, etc.), and more recently has been used increasingly in construction to produce the floorings, wall substrate materials as well as the structural members and partition materials of housing units.

Particle boards have been manufactured in Japan since the mid-1960s to effectively utilize the huge volumes of scrap and waste materials generated by the numerous plywood plants then in operation, with the objectives of supplying inexpensive wooden structural materials of excellent workability. However, due to the growing difficulty in procuring necessary plywood raw materials, many plywood plants closed down, so that the



Aerial view of Wakamatsu Wood Techno Center (Top right : Particle Board (PB) manufacturing plant and bottom right: Industrial and general waste chipping plant)



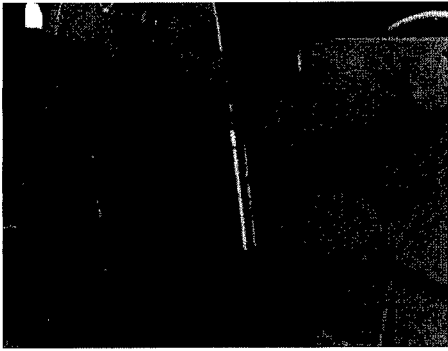
Material chips from sawmills, wood processing factories



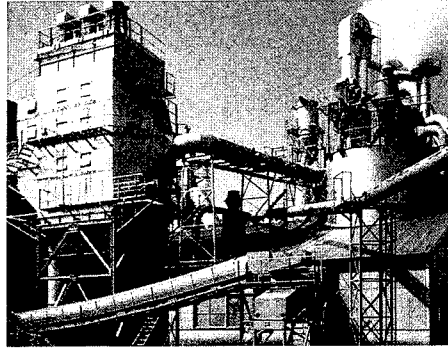
Material chips from plywood and particle board cutting wastes



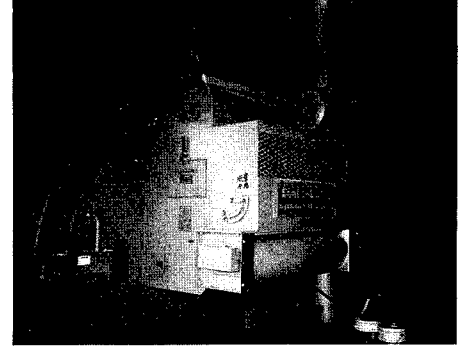
Material chips from housing waste woods, pallets and packing wastes



Hucking line



Chip dryer line



Knife ring flaker for flaking of raw chips

sources of procurement of particle board raw materials gradually shifted from wooden scrap and waste materials to the scraps generated by timber felling and, more recently, to the use of housing dismantling wastes as well as discarded furniture and other wooden wastes which were incinerated previously as general wastes or industrial wastes.

The particle board plant utilizes recycled wastes which were previously incinerated, so reduces the consumption of virgin natural resources, and utilizes these wastes as its raw materials so contributes to reducing the emission of carbon dioxide gas that is discharged into the atmosphere

through incineration, so may be regarded as an eco-oriented plant. Therefore, the particle board plant is an industrial plant that responds to present-day needs. Particle board production in Japan in 1992 was about 1,050,000 m³, in 1993 rose to 1,125,000 m³, in 1994 to 1,216,000 m³, in 1995 to 1,253,000 m³ and in 1996 to 1,292,000 m³, or is increasing steadily from year to year.

This issue introduces the Wakamatsu Particle Board Plant managed by the Particle Board Division, Dantani Corp., which has the second largest particle board manufacturing capacity in the country.

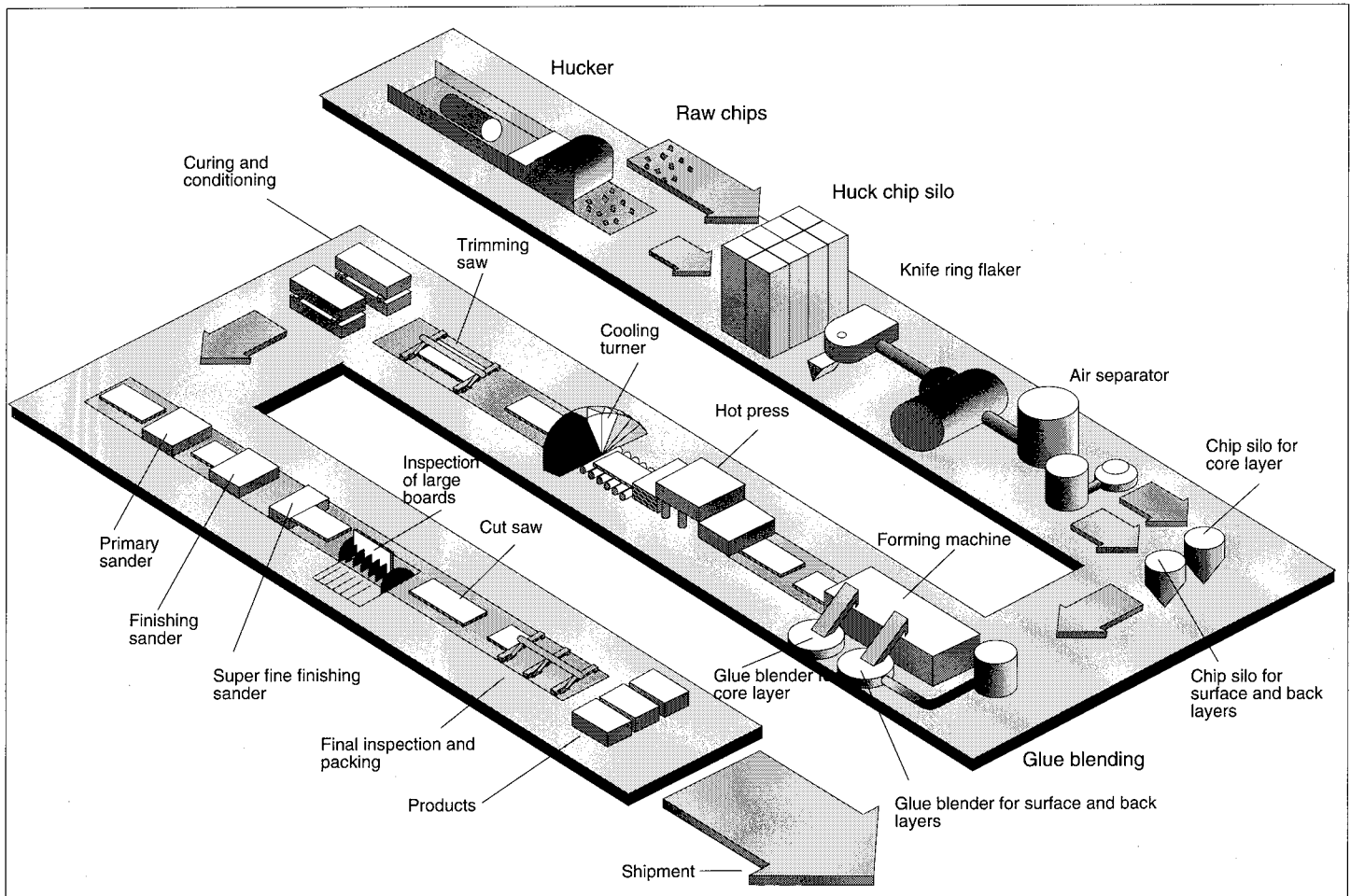
2. Description of the Wakamatsu Particle Board Plant

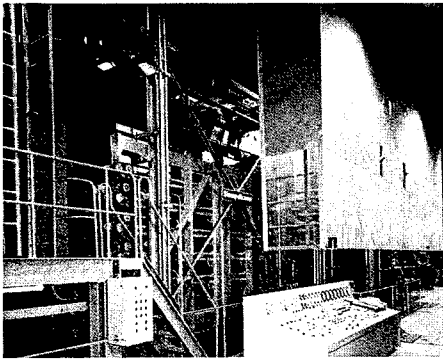
(1) Plant Site

The plant is situated in the company's Wakamatsu Wood Techno Center in Futajima, Wakamatsu-ku, Kitakyushu City, about a 3 hr flight from Tokyo to the Fukuoka International Airport and then to Futajima Station on the Japanese Railway (JR) Kagoshima Line and Chikuho Line, and then by taxi ride for about 8 min from Futajima Station.

The Center lies at the tip of an industrial complex overlooking Dokai

Fig.1 Particle Board Manufacturing Process





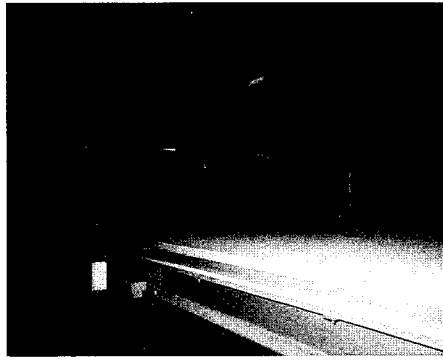
Forming and press line

Bay and has a total land area of about 180,000 m², on which are accommodated the Particle Board Plant, a Physical Distribution Center, a Housing Equipment & Structural Materials Plant belonging to an affiliated company, a Coating Plant and a Flooring Materials Plant.

The Particle Board Division's Wakamatsu Plant has a compound that is 36,900 m² wide, and an office building with a floor area of 8,000 m² (40 m x 200 m). The plant's 5-opening hot press line was constructed and commissioned into service in 1971, another line was added in 1977 and subsequently remodeled into a 7-opening hot press line in 1992, so at present two production lines are in operation: a 5-opening hot press line and a 7-opening hot press line. The labor force consists of 147 workers, and the plant is operated under the 3-shift, 24-hr working system.

(2) Products

The plant's main products are base boards, whereas other products such as decorative boards are manufactured at



Roller pressed mat

another plant. About 12-13% of the base boards are standardized products which can be mass produced, and the remaining 87-88% consist of products based on client specifications which include as many as 80 different types of boards, so adding boards meeting other specifications, the total of types is very large at 6,000-7,000 different types of boards, making the plant a center for manufacturing diversified products in small lots.

(3) Raw Material Procurement

The raw materials used by the plant are wood-felling scraps, lumber scraps, structural member scraps, wooden members from housing unit dismantling, waste wooden pallets, packaging materials, and plywood and particle board scraps, which are procured as scraps and chips from the lumber mills and woodworking plants operating in the surrounding regions. General and industrial wastes such as housing unit dismantling wooden members, wooden pallets and packaging materials are reduced to chips at the plant, so a permit

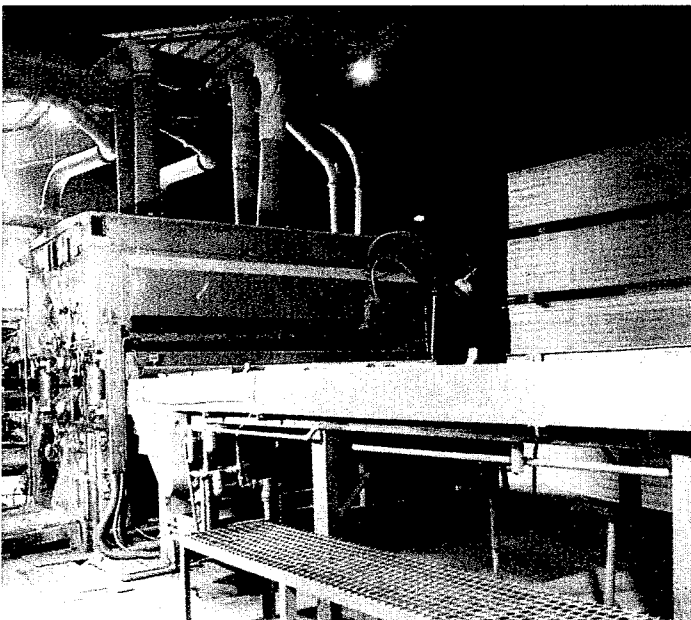


Hot pressed products

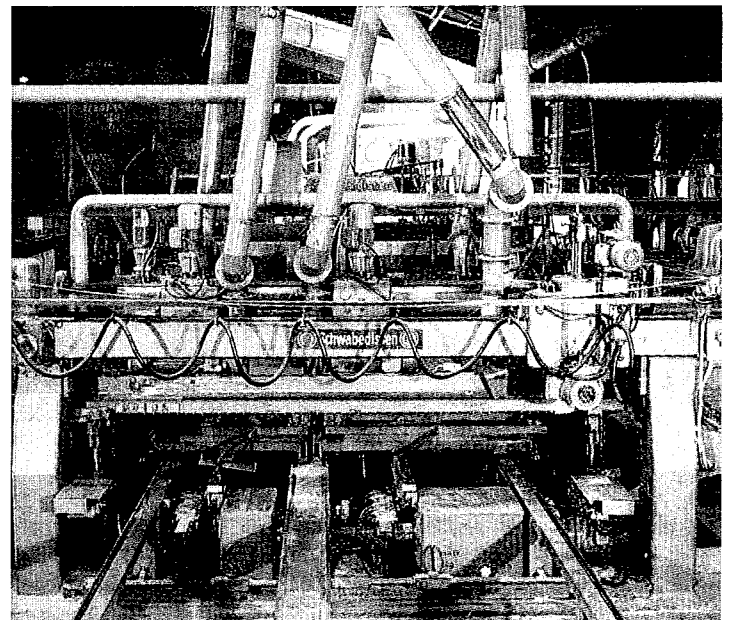
has been acquired to operate as a general and industrial waste treatment business for the operations of waste collection, transportation, treatment and processing. In 1984, a chipping facility was installed in the center, and the raw materials are transported to the plant by trucks. At present, the plant is procuring raw materials primarily from regions in Fukuoka and Oita prefectures in Kyushu.

(4) Production Capacity and Related Facilities

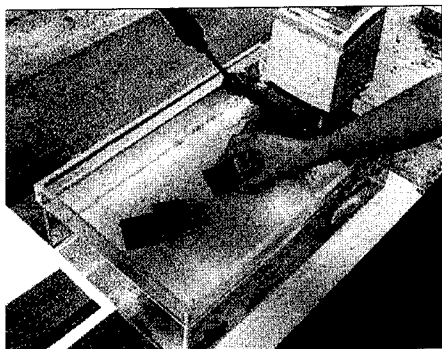
The monthly production capacity is 11,000 tons (boards with average density of 0.7 g/cm³), a capacity that is the second largest in the country. The main systems and equipment for manufacturing particle boards are manufactured in Germany and the United States, which results from the history of the establishment of the Japanese particle board industry. Central to these systems are the forming machines, the 5- and 7-opening hot presses, the glue supply line and related equipment, which are all controlled by computers.



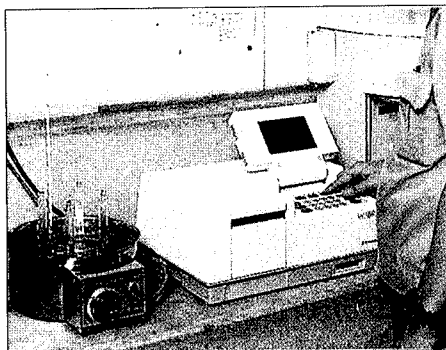
Sander line for fine finishing of particle boards



Cut saw line for accurate sizing



Water absorption test



Formalin discharge tests

(5) Production Process and Related Know-How

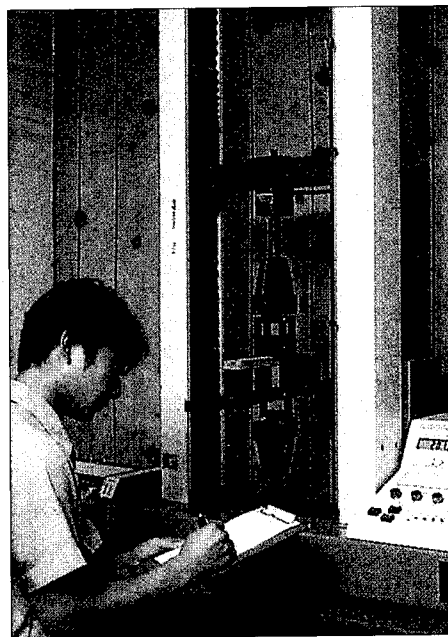
In the particle board manufacturing process, the raw material chips are stored in Huck chip silos by types, the chips flaked with knife ring flakers, and the flakes then classified into surface layer flakes and core layer flakes with an air separator. Subsequently, these classified flakes are mixed with glue in a glue blender. The raw material mixture is first used to prepare the board backside layer with a forming machine, over which the surface layer is laminated to form a sheet of board. At this stage, the formed product has a bulk that is 3-4 times thicker than the ultimate product. A roller press then compresses the board to reduce its thickness to one-half. The semi-finished product is known as the mat. This mat is next compressed continuously with 5-opening and 7-opening hot presses to the thickness and density prescribed by the specifications sheet at 170-180°C and pressure of 25-35 kg/cm². The compressed board is then at about 80°C, and the weight is measured continuously with a raw board scale, then cured. The curing period will differ with the specific type of product, but will be 4-7 days on average. The cured product thickness is treated in three stages to increase the surface uniformity, then cut into the required product dimensions. Finished products are shipped out with trucks.

Technically, the product consists of lauan wood of high dimensional stability and various types of resins which require

difficult treatments, so the quality levels of the ultimate products will depend largely on the technical expertise of the plant, or the temperature and pressure control technologies for thermally compressing the board to its required thickness and density, as well as the production technology of controlling the board spring-back force that is generated through the absorption of moisture from the air during the curing process. The plant features a high productivity and product quality due to its accumulation of excellent expertise such as its maintenance and management technology that enables the entire production system to be operated smoothly and continuously with the greatest stability, and the expertise of veteran operators.

(6) Preservation of Good Environment and Satisfaction of User Needs

The plant is recovering and recycling particle board scraps for use as the raw materials, and scraps unusable for particle board production are utilized as boiler fuel, so a clean and healthy working environment is maintained at all times. The raw materials consist of various types of general and industrial scraps which previously were incinerated for disposal, so the plant is contributing to social wellbeing by effectively utilizing these wastes as raw materials. In addition, it is responding to the needs of various enterprises by supplying inexpensive quality particle board products such as



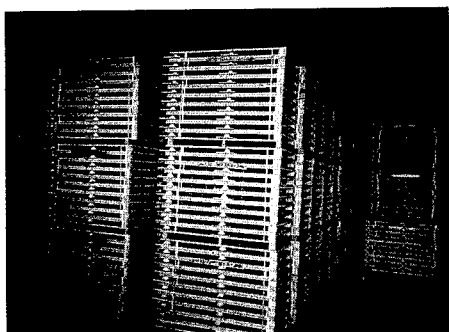
Bending strength tests

plywood, hard- and semi-hard fiber boards.

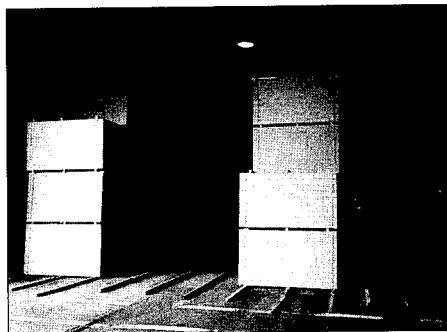
3. Postscript

The particle board produced by this plant is marketed under the brand name of Fine Holz, and recognized as The Eco-Mark product, or an environmental preservation type product, by the Japan Environment Association.

Particle board production will be influenced by the various competitive materials which are being developed in conformance with progress as well as by the particle board demands raised by home electrical appliances, for example, which are becoming increasingly compact, but the decrease is being offset by the emergence of new demand sectors, so production is continuing to increase at present. However, as observed from the manufacturing cost, the viability of the particle board plant depends on how to secure the raw materials necessary for plant operation from fixed regions with stability, so this industry demands in-depth study of its basic viability conditions before construction of new plants.



New type PB product for floor bed application



Completed products for shipment

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TOPICS

This section describes selected developments of special importance or interest due to the achievement of a breakthrough or innovation in technology.

Japan's Largest 12,300-kW Cogeneration Plant Commissioned into Service

The largest scale commercial cogeneration plant (for combination heat and electricity supply) with a power generation capacity of 12,300 kW and an ancillary large-scale regional heat supply plant was commissioned into full-scale operation from July this year in the Minato Mirai (MM or Port Future) district in Yokohama City that is currently being developed as a futuristic city.

This cogeneration facility had been under construction as the No. 2 Plant of the First-Stage Project by Minato Mirai 21 District Heating & Cooling Co., Ltd. that is in charge of regional interior conditioning in the MM region, and is installed in the first underground floor of the complex facility Queen's Square Yokohama Building, to supply heat and electricity to the Queen's Square Yokohama Building, RC Yokohama Building and other local regional buildings.

The No. 2 Plant has a cooling capacity of 12,000 refrigeration tons, heating capacity of 40 t/hr, and when used in combination with the Center Plant that is already in operation, the interior cooling capacity will be 34,510 refrigeration tons and the interior heating capacity of 168.6 t/hr. The facility can be increased in the future to a cooling capacity of 51,000 refrigeration tons and heating capacity of 322 t/hr.

The regional heat supply plant and the No. 2 Cogeneration Plant which were commissioned into full-scale operation this time are receiving national subsidies



Control room of newly constructed No.2 cogeneration system

from the New Energy and Industrial Technology Development Organization (NEDO) as integral parts of an Environment Adjustment Type Energy-Oriented Community Project for supplying surplus heat in coordination. The Center Plant uses the large-scale latent heat storage system (STL), and the No. 2 Cogeneration Plant and the regional heat supply system are the

most advanced domestic regional heating and cooling facilities.

*** Minato Mirai 21 District Heating & Cooling Co., Ltd.**

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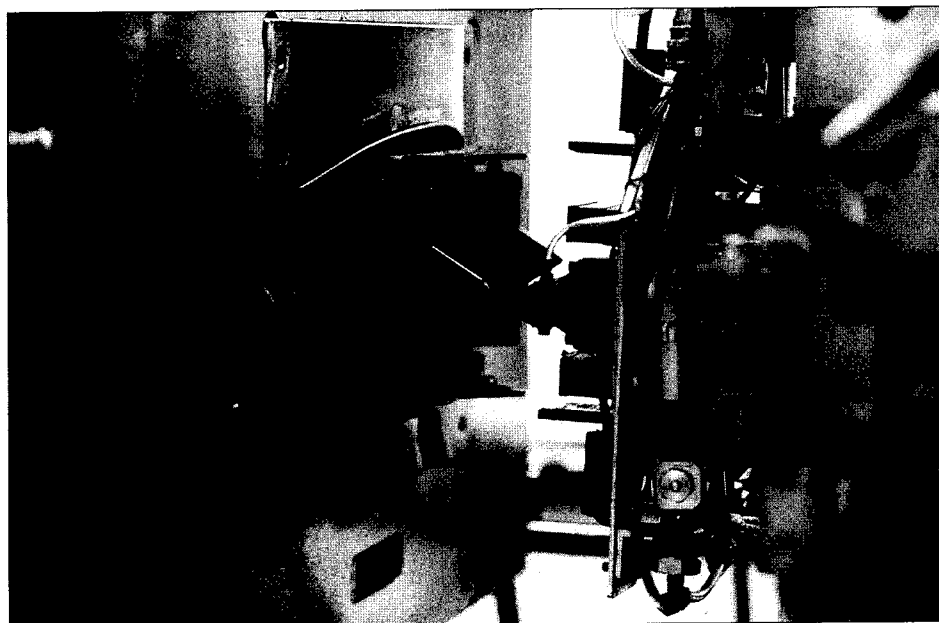
Injection Assembly Technology

—One-Piece Injection Molding of Elastomers and Rigid Resins—

Taiseiplas Co., Ltd. has established a technology to simultaneously mold various types of parts consisting of a soft material and a rigid resin, which are assembled together by the fusion-bond. Patent rights have been established for the new technology in Japan, the United States and in Europe.

This injection assembly technology involves the use of various types of elastomers compatible with rigid resins, and a die for the unit molding of these elastomers and rigid resins. Molten molding is performed by controlling the molding temperatures of various materials having different molding temperatures, for which plastic molding machines are used.

Thermoplastic elastomers have been developed which permit fusion-bonding with ABS resin, PP, PC, PBT, PMMA, EVA and LCD polymers. These elastomers feature excellent fluidity, weatherability, thermal resistance and fusion-bonding characteristics, the permanent strain at room temperature is small, and fusing occurs on the material breakdown level, depending on the grade. Using these elastomers enables the 2-3 processes which had previously been necessary for molding parts using rigid resins and soft materials to be accomplished in a single process and, in this sense, the technology is called the injection assembly technology.



Fusion-bonding operation using the patented injection assembly technology

Most technologies for molding with dies use materials of low fluidity and therefore necessarily involve some technical expertise. The injection molding technology uses different temperatures and speeds depending on the characteristics of the elastomer that is used, so also involves a specific software.

Applying the new technology enables various types of products to be molded with ease and at a lower total cost, such as waterproof goods (swimming goggles, walky talkies, hand-phones, cameras, head/rear lamps), dustproof equipment (control panels for copying machines, inner switches for cars), shockproof goods (handy-phone LCSs), shock-absorbing goods (VTR/computer components), anti-static electricity goods (ICs, PC boards, etc.), pliant parts (inside parts of automobiles and cameras), slip prevention goods (sportwear, etc.) and cosmetics containers.

The company is prepared to transfer the technology to foreign companies upon request.

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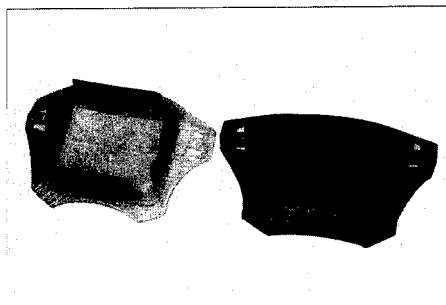
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Air bag cover of automobile made of special elastomer and rigid resin using new technology



Hand-phone cover

NATIONAL R&D PROJECTS

This section describes various R&D projects being carried out in Japan on a national scale.

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Life Cycle Assessment of Lithium Batteries

1. Introduction

The Transport and Storage Technology Subcommittee for Power and Other Energy Resources (chairman: Kiichiro Takehara, Prof. Emeritus of Kyoto University) of the Energy Environment Technical Development Committee, Industrial Technology Inquiry Board, has conducted life cycle assessment (LCA) of lithium batteries in conformance with the recommendation in the interim evaluation report (September 1996) of the project concerned, and marks the first LCA under the New Sunshine Program.

According to the results of the LCA, the emission of carbon dioxide (CO₂) gas in the life cycles of electric vehicles mounting lithium batteries is less than one-half that of gasoline vehicles, which quantitatively underscores the significance of research to develop lithium batteries. A huge quantity of energy is consumed in the process of manufacturing anodes, which shows the importance of recycling lithium batteries. The New Sunshine Program Promotion Headquarters plans to conduct LCA appropriately with respect to other projects in view of the vital nature of the assessment.

2. Description of Interim Assessment Report

(1) Introduction

The objective of life cycle assessment (LCA) is to assess the environmental loads (gas emission volume and energy consumption volume) imposed by products, services and social infrastructures during their total life cycles (from the process of raw material excavation through the processes of manufacture, distribution, consumption and use, and disposal and recycling), so quantitatively, scientifically and objectively evaluating the influences exerted on the global environment.

(2) Calculation of Energy Consumption and CO₂ Emission Volumes During Life Cycles of Lithium Batteries

The energy consumption and CO₂ emission volumes in the life cycles of gasoline vehicles and electric vehicles mounting lithium batteries are shown in the accompanying table. The energy consumption of electric vehicles is larger in the manufacturing process, but when observed from the total life cycle, the energy consumption is about 60% and CO₂ emission volume less than one-half compared with the gasoline vehicle. However, a large quantity of en-

	Energy Consumption Volume (10 ³ kcal)		CO ₂ Emission Volume (kg-CO ₂)	
	Gasoline Vehicle	Electric Vehicle	Gasoline Vehicle	Electric Vehicle
Manufacturing Process	21,282	32,687	4,507	6,996
Manufacture of Car Body	21,282	20,490	4,507	4,239
Manufacture of Lithium Battery	—	12,196	—	2,756
Running	76,364	23,824	21,442	4,704
Maintenance	2,677	1,951	664	453
Disposal	34	946	7	193
Total	100,356	59,409	26,619	12,345

Note: The running distance is 100,000 km.

The power CO₂ emission specific unit is computed from the average value of total power sources (average power source composition as of FY 1995).

Reference Data

Fig. (1) Comparison of Energy Consumption Volumes (Running Distance 200,000 Km)

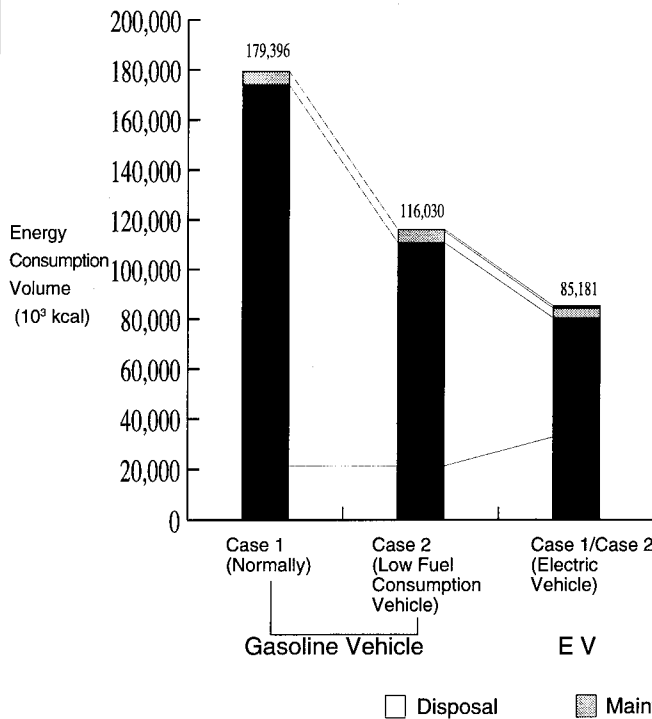


Fig.(2) Comparison of Energy Consumption Volumes (Running Distance 100,000 km)

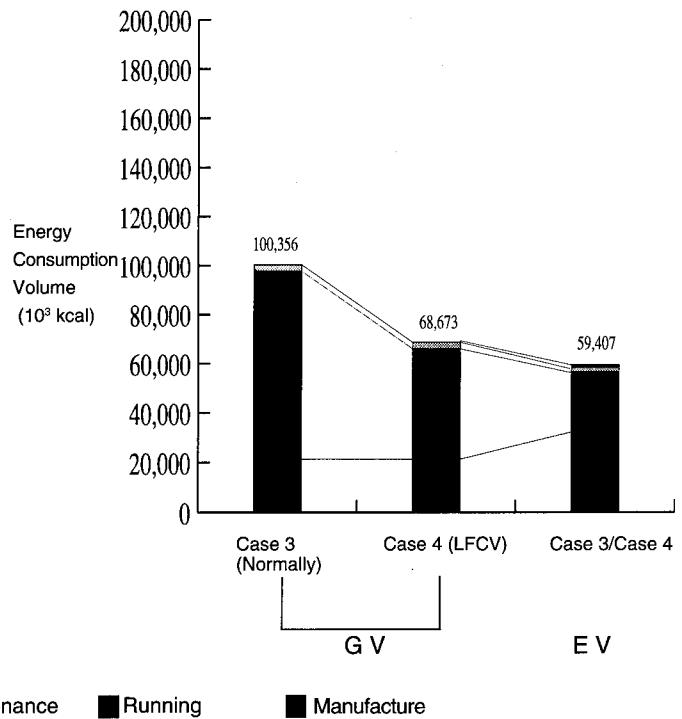


Fig. (3) Comparison of CO₂ Emission Volume (Running Distance 200,000 km)

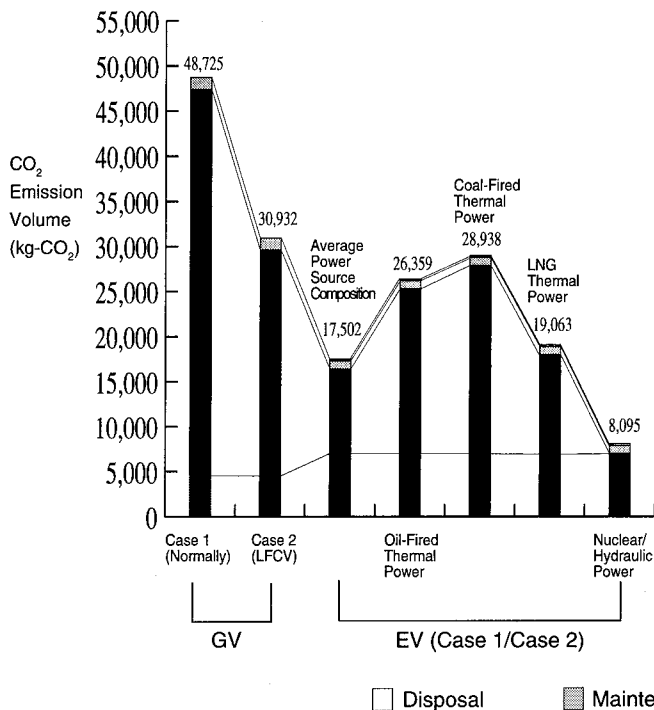
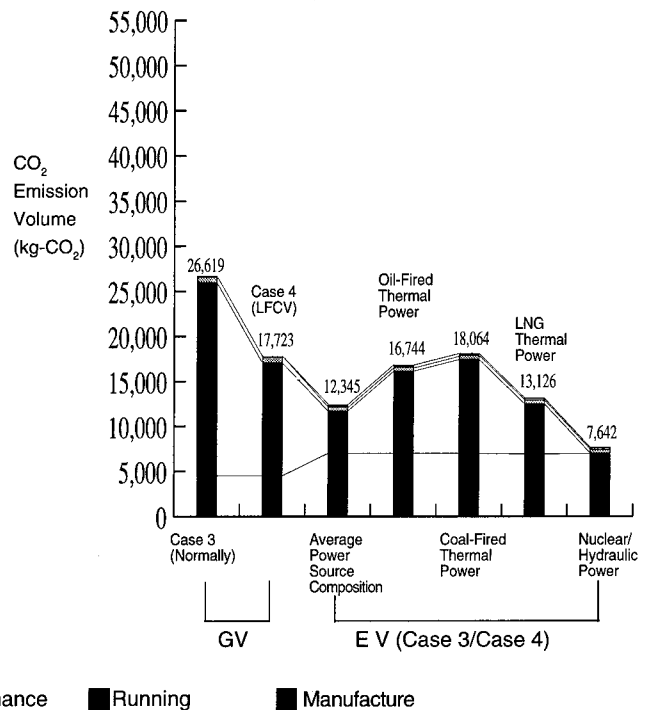


Fig. (4) Comparison of CO₂ Emission Volume (Running Distance 100,000 km)



ergy is consumed to produce the anodes in the process of manufacturing lithium batteries.

3. Recycling of Large Lithium Batteries

The recycling of lithium batteries may be classified into the recycling and reutilization of the battery, the reutilization of materials recovered from constituent parts, and energy recovery through incineration, and the adoption of sequential cascaded reutilization is essen-

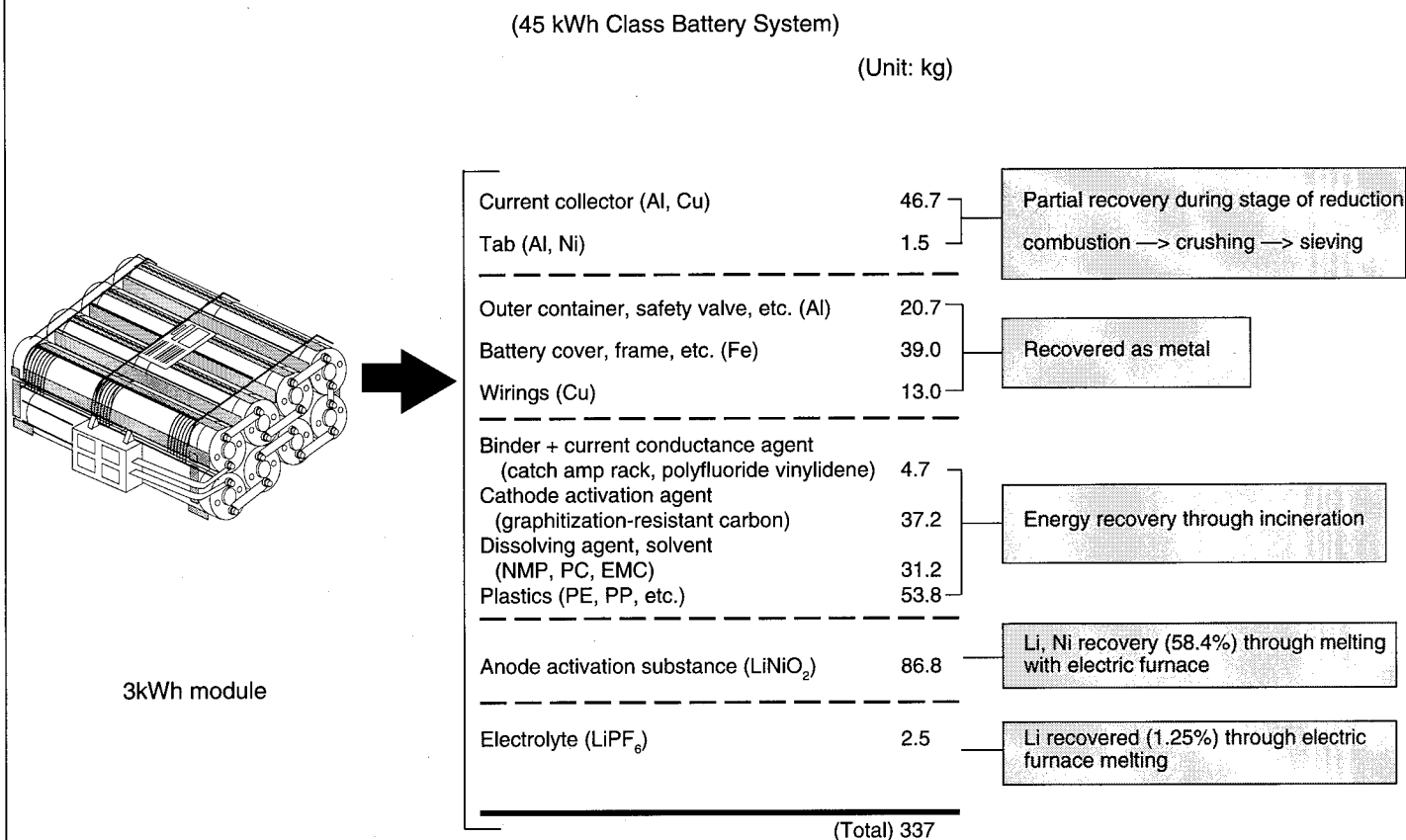
tial in descending order. The recycling ratio of lithium batteries (recycled volume/total lithium battery weight) is estimated at 84%.

Studies are in progress on the electric furnace melting process and the ammonia diffusion process as the methods for recovering nickel and cobalt from lithium batteries, and whichever the process, about the same volume of energy for their refining from ore will be necessary, so these processes are highly significant from the aspect of recycling valuable natural resources.

4. Application of LCA Results to Other R&D Projects

The systems, facilities and equipment developed through the New Sunshine Program should feature low energy and environmental loads as viewed from their overall life cycles. Therefore, it will be necessary to introduce the LCA technique into projects other than in connection with lithium batteries considering the characteristics of the R&D projects, and to reflect these LCA results in these projects.

Fig. (5) Recycling of Lithium Battery Constituent Parts.



Assuming the metal recovery ratio of the electric collector and tab as 50%

$$283\text{kg} / 337\text{kg} = 0.84$$

GENERIC TECHNOLOGY REVIEW

Elucidation of the Mechanism of Explosive Reaction of Hazardous Reactive Gases and Prevention of Explosion

Fabrication of New Materials with Assemblies of Polymers Containing Chelating Moiety and Their Application for Separation and Detection of Trace Metal Elements

This section describes various basic research and development activities in Japan to inform the world about generic R&D efforts here.

Elucidation of the Mechanism of Explosive Reaction of Hazardous Reactive Gases and Prevention of Explosion

National Institute of Materials and Chemical Research

1. Objective of Research

As a recent trend, various types of new industrial gases are coming into use one after another in concert with industrial sophistication. Included among these new gases are many hazardous reactive gases demanding cautious handling. However, actually, priority is usually given to the effective utilization of these gases as industrial raw materials for specific manufacturing purposes, without giving due thought to the details of their reactive hazards. The objectives of this research project are to elucidate the reactive hazard-ousness of these gases in details, to develop a generic technique to elucidate the mechanism of explosive reaction of these gases, and to establish safety technologies for explosion prevention.

2. Research Plan

Research is to be advanced to establish a generic technique to elucidate the mechanisms of combustion and explosion of new inorganic gases. For this, it will be necessary to measure the combustion and explosion characteristics of those gases mixed with air through ignition and explosion experiments, as well as to study these

JETRO, October 1997

mechanisms in depth to explain these related phenomena. The reaction rates of the main elementary reactions are to be computed using the molecular orbital method and transition state theory in connection with the main anticipated elementary reactions to anticipate the reaction routes and to prepare numerical models. Also, based on the prepared models, the ignition, flame transmission and detonation transmission phenomena are to be simulated and calculated. For these calculations, a fluid dynamics analysis program based on elementary reactive models is to be developed that is linked to the technologies to estimate explosive hazards. For the model substance is selected phosphine.

Meanwhile, in order to evaluate the quantitative hazards of new substances, especially fluorine, ozone and other powerful oxydant, various types of mixed gases are to be prepared by using these gases in combination with hydrogen and other combustible gases to elucidate and evaluate such ignition and explosion hazards as well as to establish the conditions to prevent explosions.

3. Background of Research

In concert with technological innovation, the types of gases used industrially are increasing, so are the hazards involved. Academically, there is a need to establish a reactive chemistry system for reactively hazardous gases and, at the same time, from the

perspective of industrial safety, it will also be necessary to accumulate fundamental explosion data and to establish explosion prevention technologies.

Intensive research has been advanced up till now on the combustion and explosion of hydrocarbon substances, so their mechanisms of reaction are well known. However, hardly any research is being conducted on the combustion and explosion reactions of new chemical substances. The sole exception is silane, and this research team concerned has also participated actively in related research. In this research project, the objective is to further sophisticate the methods for conducting research and to establish a generic method to elucidate the combustion and explosion reactions relating to various types of new chemical substances.

Meanwhile, due to the revision of the High-Pressure Gas Control Law in 1991, which introduced stricter high-pressure gas consumption standards, the trend of legal controls is to shift to more detailed controls depending on the specific characteristics of the gases handled. Namely, regarding new types of highly hazardous gases, rigid demands are being placed on the accumulation of accurate hazard data, the establishment of appropriate evaluation methods and the establishment of effective explosion prevention technologies.

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Fabrication of New Materials with Assemblies of Polymers Containing Chelating Moiety and Their Application for Separation and Detection of Trace Metal Elements

Tohoku National Industrial Research Institute

Chelating polymers are well known to be very useful materials for the uptake of trace metal elements from their dilute solutions. A well-organized arrangement of chelating functional groups in base polymers is one of the most possible ways to produce excellent chelating polymers. In this research project, we are studying on development of highly selective chelating polymers in a form of film or particle by way of careful control of the structure of chelating groups in the polymers.

Some kinds of organic polymers form a selfassembly like a Langmuir-Blodgett (LB) membrane. This polymer-type LB film has a great advantage on mechanical stability over monomer-type one. Mechanical stability is one of the most essential requirement for the practical use of the films.

In this research project, we are trying to incorporate chelating moiety into some polymers which form LB films. We are

trying to apply them for separation and detection of trace metal elements. In a preliminary test, an LB membrane with polyacryamide having 8-amino-quinoline groups (Fig. 1) has been fabricated. Combination of such polymer-assemblies with appropriate electrodes or semi-conductors can be new type of sensors for metal ions. We have confirmed that silver(I) ion

is successfully detected or captured from its dilute solution (4×10^{-4} mol dm⁻³) with the electrodes coated with the chelating LB membrane. Moreover, a new approach to produce chelating LB membrane are also going to be investigated in this project. That is, a mixed use of a bi-functional chelating reagent and basic polymer LB films is expected to be another way to

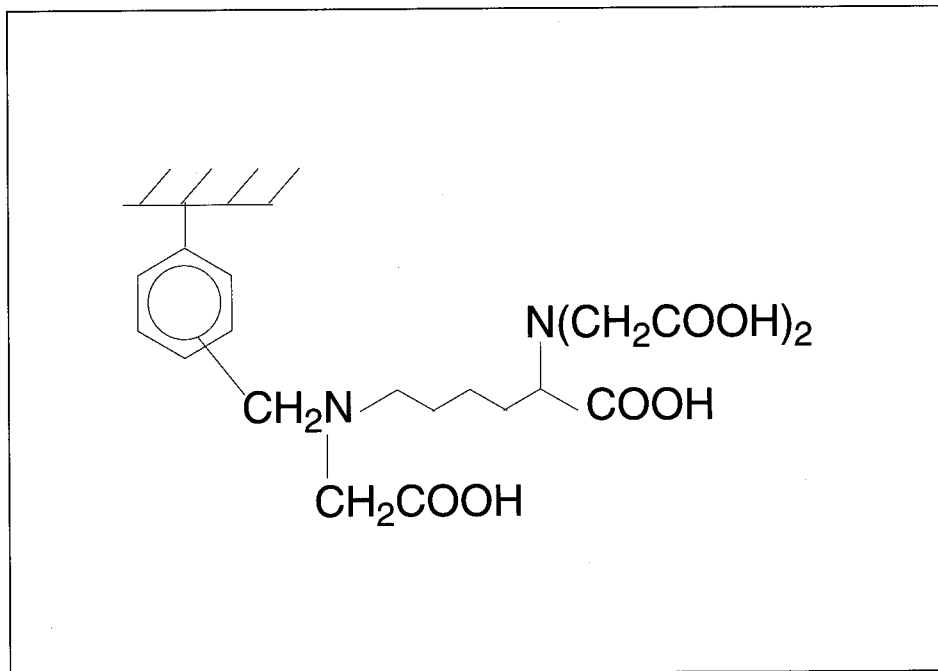


Fig. 2 LTA Chelating Polymer

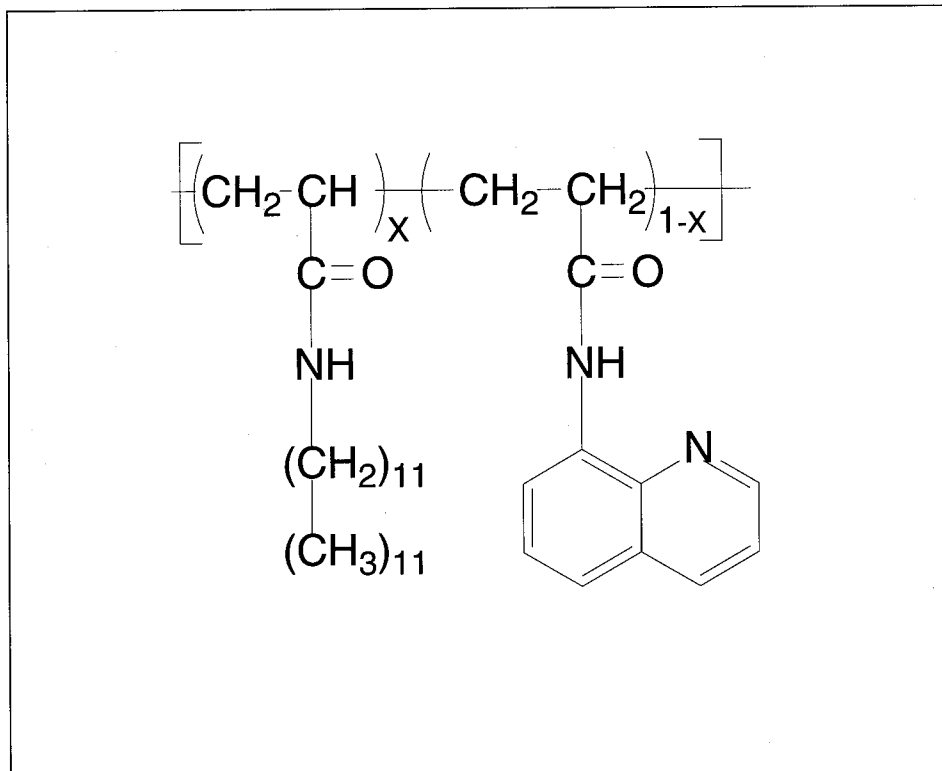


Fig. 1 Polyacrylamide with 8-amino-quinoline

have chelating polymer LB membrane. Possibility of this method is also checked and studied in this research project.

Arrangement or assembling of chelating functional groups should be attended to and well organized in order to produce excellent chelating polymer particles besides films. Polystyrene resins having multi-dentate chelating groups will be synthesized in this project.

A chelating resin with lysine-N α , N α -triacetic acid groups (LTA, Fig. 2) has been already synthesized and the removal of trace selenium (IV) (1ppm) with this resin loaded with iron (III) has been successfully carried out. Desirable structure for selective separation and concentration of trace metal elements will be also searched for and the information will be summarized for development of more effective materials.

97-10-100-01

Stack Cell Technology for Futuristic DRAMs

Toshiba Corp. has established a stack cell technology that enables the mass production of futuristic DRAMs with capacities of over 1 Gbit and line widths of about 0.15 μm . The technology was established by producing the master pattern in a simple rectilinear shape for ease of mask pattern transfer onto wafers and by introducing a fully self-aligning technique for arranging the bit wires and capacitors in direct wiring (contact) with the active region. For capacitors, the method of forming a ferroelectric type of film in the concave part of the interlayer insulating film is adopted, and an excellent surface flatness has been attained that is required in particular with stack cells.

The new stack cell technology is characterized by the self-aligned polyplug, cross-point contact and concave capacitor. The self-aligned polyplug is a self-alignment technology using the gate as the standard. The space between the gate covered with silicon nitride film is filled with a boron-phosphorus-silicate glass (BPSG), the BPSG is removed by selectively etching the nitride film, after which the plug is formed by doped polycrystalline silicon.

For the cross-point contact, the interlayer film covering the polyplug is patterned in groove shape and a nitride film adhered on the side wall, the groove filled with tungsten to form the bit wire, and a nitride film formed on the upper part of the tungsten. Another doped polycrystalline silicon is formed by the self-aligned technique after the bit wiring. This connects to the polyplug to form the contact between the capacitor and the active region.

For the concave capacitor, a silicon oxide film formed on the bit wire is etched in concave structure to successively form the electrode ruthenium film, barium-strontium-titanate (BST) film and another ruthenium film. A uniform flatness is obtained with ease since there is little level

difference with respect to the oxide film surface.

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97-10-100-02

Starting-Out Stage of Ram Accelerator Projectile Visualized

Prof. K. Takayama, Assoc. Prof. A. Sasoh and their research team of the Shock Wave Research Center, Institute of Fluid Science, Tohoku University, have applied the holographic interferometer to visualize the starting-out process of the ram accelerator projectile that is attracting attention as a new space projection system. The shock wave generated when the ram accelerator projectile breaks through the Mylar diaphragm and enters into the ram acceleration domain was captured successfully.

With the ram accelerator projectile, its fuel and an oxidizing agent are packed inside the acceleration tube, and the mixed gas ignited by the shock wave generated when an object passes through the mixed gas at a supersonic speed, which increases the pressure at the rearside of the

object to generate an acceleration force. Compared with the conventional type of rocket, it has the potential of projecting an incomparably massive load into outer space.

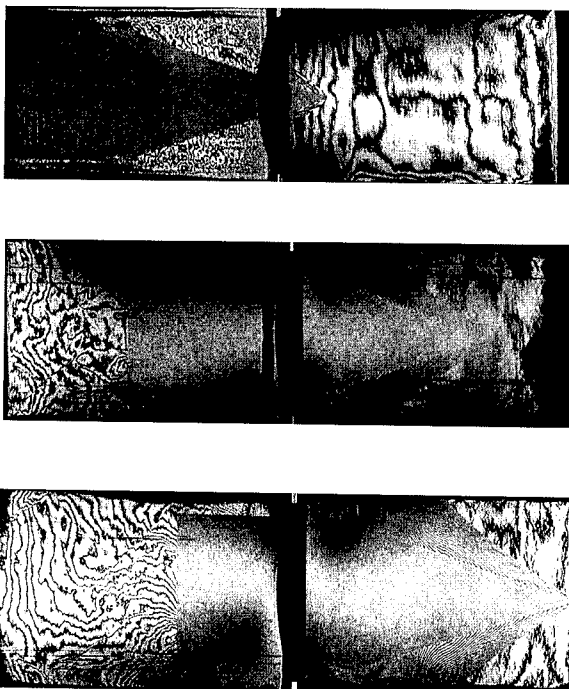
The research team used an aspherical lenses, applied the holographic interferometer, and succeeded in visualizing the flow of the surrounding environment when the projectile (overall length about 100 mm, speed 1.1 km/s) penetrates through the ram acceleration part (inner diameter 25 mm, overall length about 6 m).

The numerical calculation model adopted previously is designed to make observations of the vertical waves (shock waves and expansion waves) in the front and back of the diaphragm, but actually, the vertical waves were not observed, indicating that the conventional model is incorrect. As a result, it is now possible for the first time to make accurate simulations by using a computer.

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Reconstructed interferograms of projectile entry process by piercing Mylar diaphragm, $p_2=0.1 \text{ MPa}$, $p_3=1.0 \text{ MPa}$, single layer diaphragm (thickness=100 μm); a, $U_p=1051 \text{ m/s}$; b, $U_p=1098 \text{ m/s}$; c, $U_p=1102 \text{ m/s}$



97-10-100-03

Technology for Plating Ferrite Film onto Ultrafine Plastic Spheres

Prof. M. Abe and his research team of the Faculty of Engineering, Tokyo Institute of Technology, have applied the sonochemical technique (application of power ultrasound waves to stimulate chemical reaction) to ferrite plating and succeeded in uniformly depositing ferrite films onto ultrafine plastic spheres with diameters of $0.25\text{ }\mu\text{m}$. By the conventional process, when the sphere diameters become smaller than $0.3\text{ }\mu\text{m}$, only islands are generated and it becomes impossible to plate the ferrite films.

The ultrasonic waves are conceived to reform the surfaces of the ultrafine spheres and to permit the formation of films continuously. This technology is attracting atten-

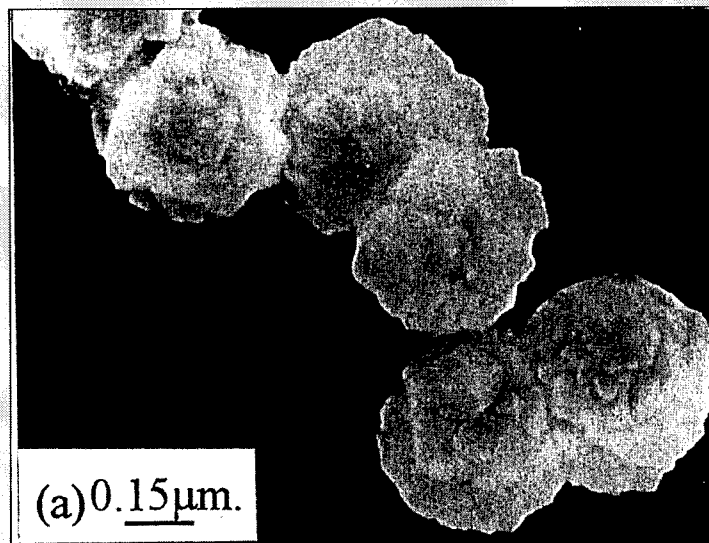
tion as the first example of application of the power ultrasound waves to the formation of inorganic thin films.

Ferrite plating enables plating to be accomplished in an aqueous solution of less than $100\text{ }^{\circ}\text{C}$ regardless of the type and shape of the substrate material. Magnetic ultrafine spheres produced by plating ferrite onto plastic spheres have been commercialized for use as a cancer diagnosis reagent by utilizing the immunity reaction. However, when the sphere diameters become less than $0.3\text{ }\mu\text{m}$, there had been the problem of the ferrite being formed in islands and not coating the entire surface.

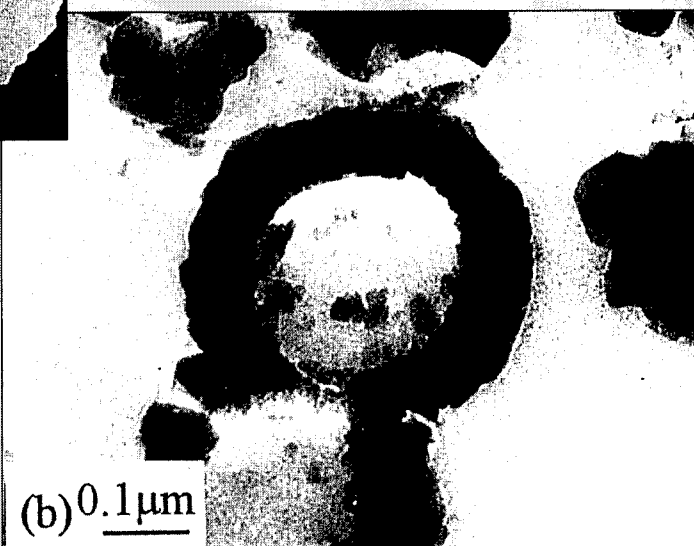
Therefore, the ultrasonic irradiation chemical process was used in the ultrasonic enhanced ferrite plating process. Ultrasonic waves were

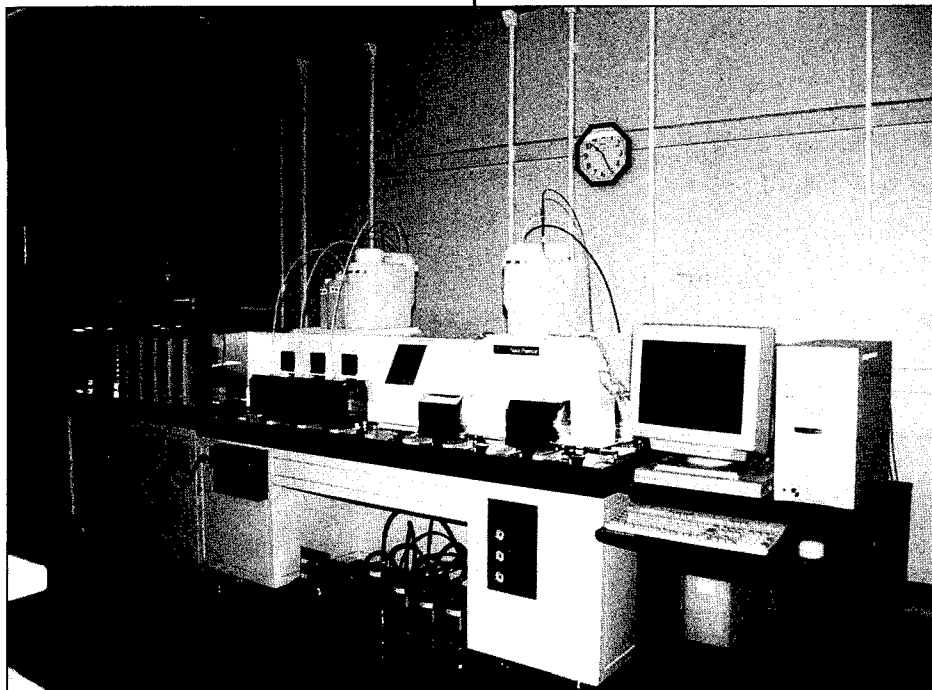
directed on a ferrite plating reaction, and plating performed for 90 min on polyacryl spheres with a diameter of $0.25\text{ }\mu\text{m}$. It was possible to coat the surface uniformly with a ferrite film with a thickness of $0.1\text{ }\mu\text{m}$. The film consisted only of a ferromagnetic component, and the magnetic property was improved by three times compared with when no ultrasonic wave was irradiated. As a result, the immunity reagent property was improved considerably. In addition, the range of applications of magnetic ultrafine spheres will be widened to, for example, a copying machine toner as well as a tape back-coating material.

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(a) SEM and (b) TEM observation of surface and cross section, respectively, of microspheres encapsulated with ferrite under ultrasound irradiation.





*System for Refining DNA Specimens
Most Efficiently*

97-10-100-04

System for Refining DNA Specimens Most Efficiently

The Life Science Tsukuba Research Center of the Institute of Physical and Chemical Research (RIKEN) has developed a system to effectively refine the DNA specimens which are indispensable for gene analysis. The system can produce 40,000 units/day of deoxyribonucleic acid (DNA) specimens, which is a production capacity that is 200 times that of the conventional system that partially requires manual operation.

A newly developed technology is applied that enables only plasmid to be adsorbed selectively with glass fiber from a culturing liquid that proliferates plasmids by using *E. coli*. Also, the conditions were set successfully for recovering plasmids selectively at a high purity from an acidic culturing liquid. The series of processes from adsorption to washing can be performed by using glass fiber inside the same container, by which the processing capacity was improved considerably through automation.

Methods for refining DNA include the polymerase chain reaction (PCR) process as well as the plasmid process, but the latter process is applicable to DNA samples containing a large number of base pairs.

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97-10-100-05

Millimeter Wavelength Doppler Radar for Fog Observations

Prof. S. Fukao and his research team of the Radio Atmospheric Science Center (RASC) of Kyoto University and Mitsubishi Electric Corp. have collaboratively developed a prototype millimeter wavelength Doppler radar for fog observations. The magnetron with unstable oscillation is used with excellent stability by introducing the digital signal processing technique, by which it became possible to capture the motion of superfine particles. The system is installed at the Shigaraki MU (Middle and Upper atmosphere) Observatory of RASC in Shiga prefecture.

With this radar system, a millimeter radio wave is transmitted to the fog layer, and the behavior of the fog is assessed by receiving the scattered radio waves. The Doppler effect that is caused by moving particles is utilized. The system is a pulse Doppler radar with a operational frequency of 34.75 GHz and peak transmitted power of 100 kW. The antenna is a Cassegrain type with a diameter of 2 m.

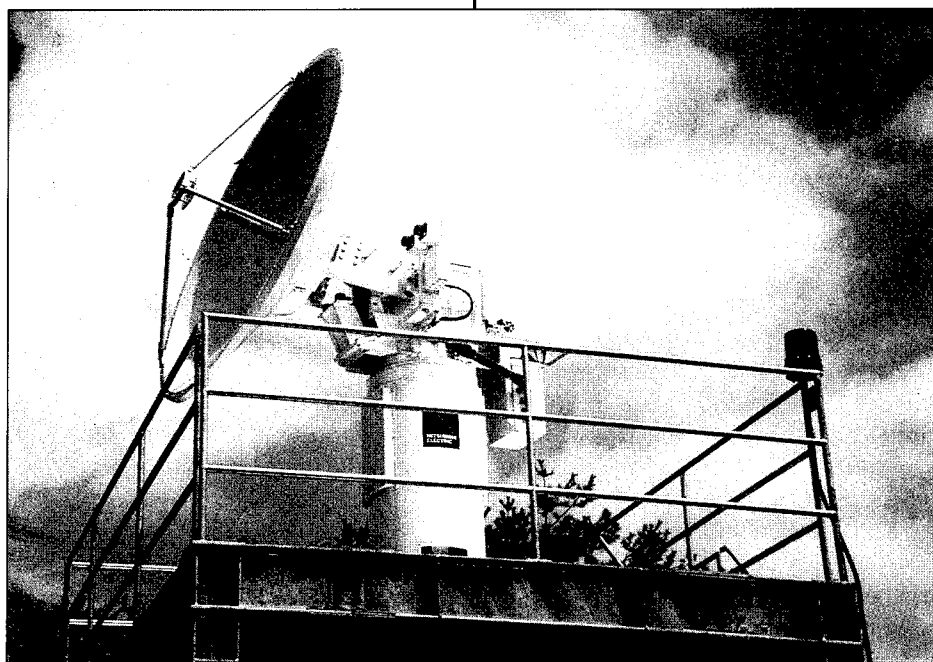
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*Millimeter Wavelength Doppler Radar
for Fog Observations*



NEW TECHNOLOGY & PRODUCTS

This section provides information about recently developed technologies and products, divided into Advanced Materials, Electronics & Optics, Information & Communications, Process & Production Engineering, Construction & Transportation, Energy, Environment, and Biotechnology & Medical Science.

Advanced Materials

97-10-001-01

Magnetic Shield Manufacturing Technology Using High-Temperature Superconducting Material

The Japan Science and Thechnology Corp. has succeeded in establishing a technology using a bismuth oxide-based superconducting material to manufacture a magnetic shield that provides protection against the magnetic noise generated by electrical and electronic equipment, through a research and development project consigned to Hitachi Chemical Industry Co., Ltd. and Hitachi Cable, Ltd.

Hitachi Chemical Industry developed a shield for weak magnetic fields, and Hitachi Cable a shield for ferromagnetic fields such as those generated by magnetic resonance imaging (MRI) systems for medical use. Both shields are usable at the liquefied nitrogen temperature (-196 °C), and therefore have a broad range of applications including use in hospitals and industrial plants. The bismuth-based superconducting magnetic shield was initially developed based on research advanced by Prof. K. Fueki and his research team of the Science University of Tokyo, Prof.K.Kitazawa of the University of Tokyo, Prof. H. Maeda of Tohoku University, and others.

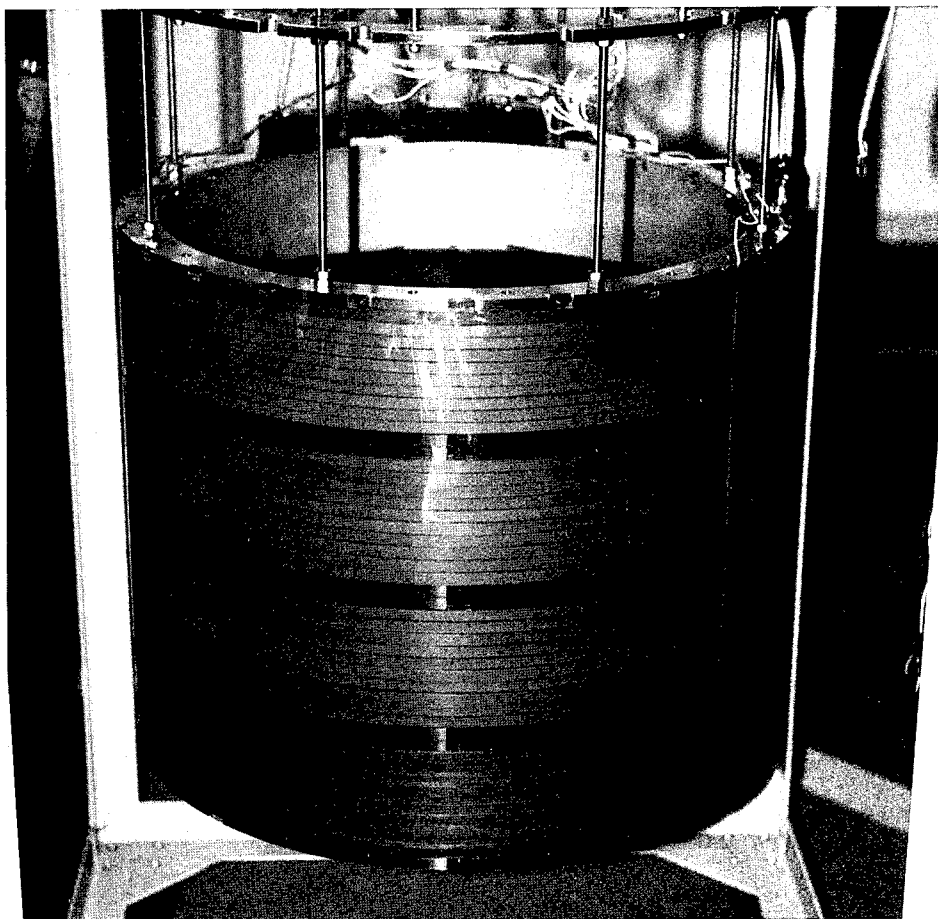
The raw material for producing shields for weak magnetic fields is prepared by drying, calcining, crushing and sintering a material consisting of powdered bismuth, copper oxide, strontium and calcium car-

bonate in a constituent ratio of 2-2-1-2. This technique prepares these powders so that their melting temperatures will differ by a few degrees centigrade depending on the state of the mixture. The prepared powders are processed into sheet form, adhered with an alloy coated with silver, then cal-

cined. This process is repeated to obtain a three-layered structure. Powders of different melting temperatures are used and the temperature controlled rigidly to produce the laminar calcined substance.

The shield for ferromagnetic fields is produced from the same material but with

Shield for ferromagnetic fields





Shield for weak magnetic fields

a mixture ratio of 2-2-2-3, so the volume of carbonates such as strontium and calcium is larger compared with the material for producing a shield for weak ferromagnetic fields. The prepared raw material powder mixture is packed inside a silver pipe and elongated, several of these pipes further packed inside a silver pipe, then formed into a thin pipe through repeated elongation. Next, rolling and high-temperature calcining are repeated to produce the shielding material in tape form with a thickness of 0.5 mm and width of 9 mm.

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97-10-001-02

Electromagnetic Wave-Shielding Nickel Fiber Material

Osaka Gas Co., Ltd. and Nippon Sheet Glass Environmental Amenity Co., Ltd. have commenced sales of a newly developed high-purity nickel fiber sheet for electromagnetic wave shielding.

This new product Magsheet is a nickel fiber sheet consisting of 99.9% of nickel with a thickness of 1 mm. Nickel is electroplated on a coal-based carbon fiber that is then sintered to remove the carbon fiber. When working with electromagnetic waves from 20 MHz to 1 GHz, the sheet features a shielding property attenuating the voltage to a hundred thousandth part. The sheet is non-combustible, and workable with greater ease than conventional types of sheets made of metal foil and other materials.

The research team plans to accept orders for the electromagnetic shielding of hospitals, broadcasting stations and industrial plants. By about November this year, it intends to also sell a thin type with a thickness of 0.5 mm, also to sell electromagnetic wave shielding sheets for

electrical and electronic products such as personal computers.

*** Nippon Sheet Glass Environmental Amenity Co., Ltd.**

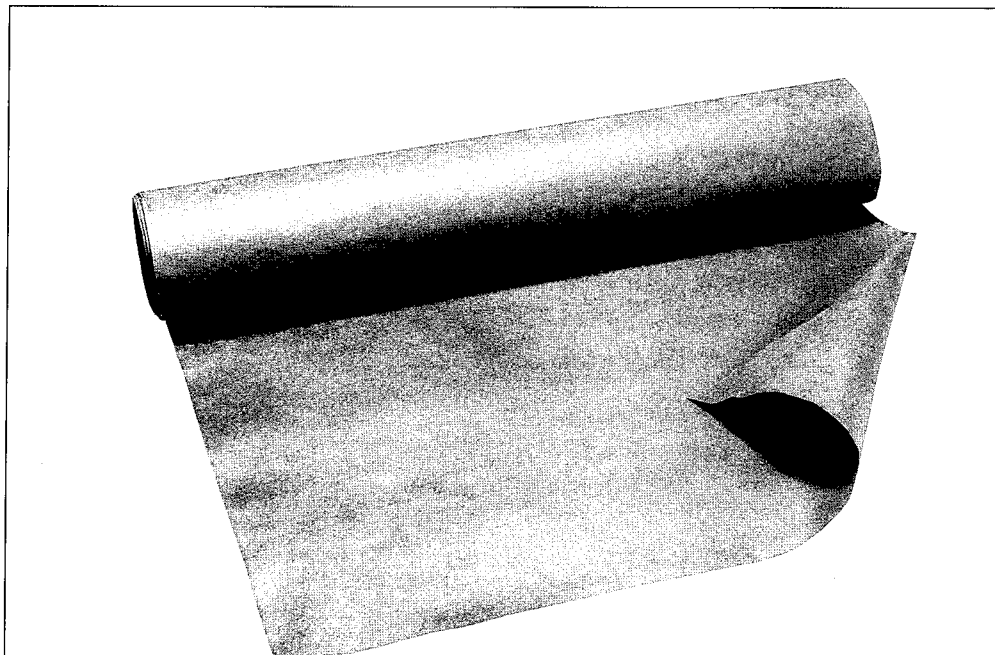
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97-10-001-03

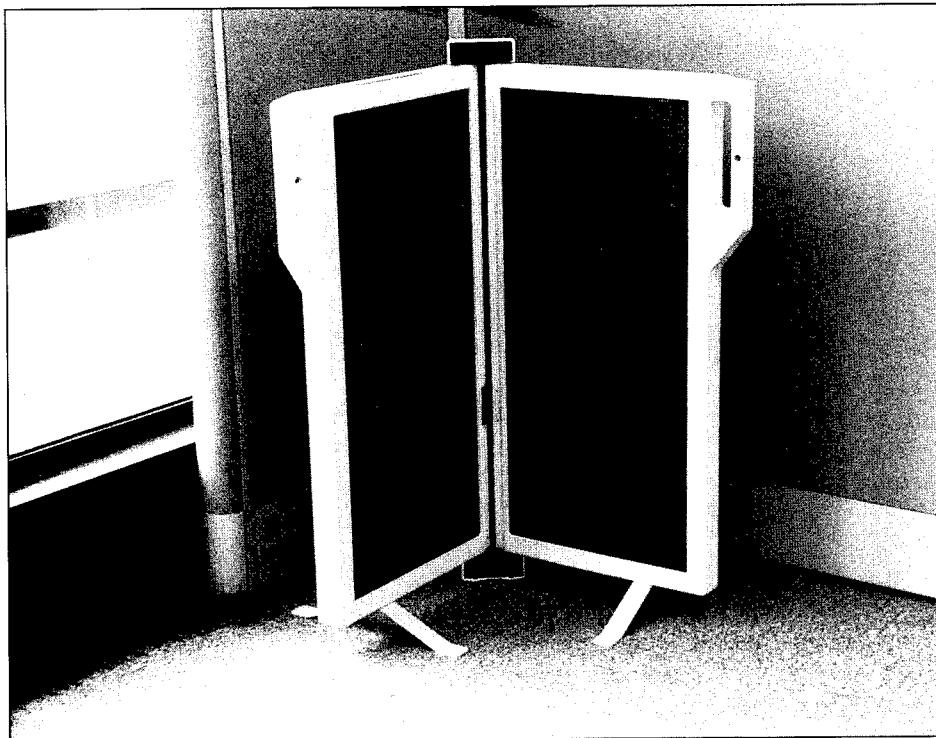
Water-Soluble Heat Generation Paint Material

Heat System Research & Industry Inc. that is engaged in the development of heat generation materials has developed a water-soluble heat generation paint material that consists of a compound ceramic consisting mainly of a titanium-based metal and zirconium. By painting the material on a flat insulating plate, followed with drying, a heating element can be produced with ease. The company plans to work jointly with Figler Co., Ltd. that is a manufacturer of glass products and to develop and commercialize household heaters using this heating element.

The newly developed heat generation material is a compound ceramic material of dark gray color. It is dissolved in water, painted on stone or concrete insulation materials, then



Magsheet



Thin heater for home use

dried to produce a heating element. By fitting an electrode on this element and passing an AC or a DC electric current, the element temperature can be raised up to the maximum of 350 °C.

Compared with nichrome or carbon heating elements, this heating element features an excellent heat generation efficiency, or heat is generated on its entire surface and the temperature raised rapidly. A large quantity of far infrared radiation is discharged, and an excellent energy conservation effect is displayed. When a current of 1,000 W is passed through a heating element 60 cm long and 90 cm wide, a fixed temperature level is attained as rapidly as in one-fourth to one-fifth the time normally required.

The company has no manufacturing facilities, so the heating element manufacture will be undertaken by Figler Co., Ltd. The company's parent company Hokubu Communications Industrial Co., Ltd., is planning to manufacture an initial line of products such as thin heaters for home use, far infrared ray heaters for food drying, and snow-thawing con-

crete. In addition, enterprises interested in the heating element will be recruited to develop applied products jointly. The sales revenue target for the initial year is ¥250,000,000.

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97-10-001-04

New Soft Ultrafine-Fiber Fabric for Interior Use

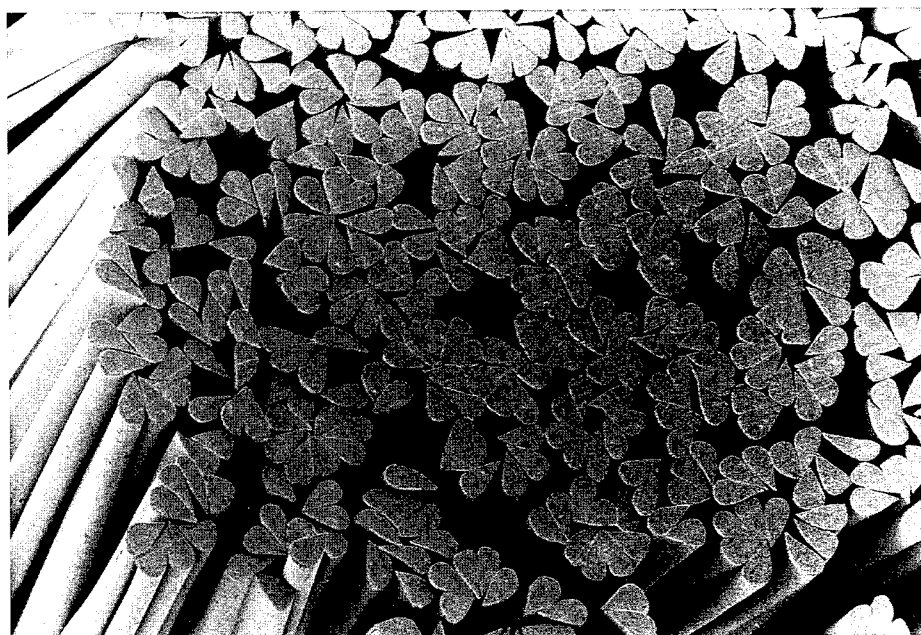
Unitika, Ltd. has developed a new type of polyester-based fabric for interior use and plans to market the fabric from autumn this year. An ultrafine fiber with a diameter of 0.13 denier (1 denier = thickness of thread weighing 1 g per 9,000 m) is knit and finished into a very soft fabric, with a further fine layer of fibers on the surface to display a sense of elasticity resembling that of natural hide. The fabric is called Silseim and is ideal for producing sofas and chair lining cloth.

The fabric is produced by a multi-component complex spinning technology which first spins an ultrafine polyester-based fiber into thread form, then immerses the thread in a special type of solvent, and the unnecessary parts are removed by washing to finish the fiber into an ultrafine fiber. After the fabric is finished, the surface is combed to form the more ultrafine fiber fabric.

The fabric will be sold at a domestic price of slightly over ¥10,000/m (width 148 cm).

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Silseim



Electronics & Optics

97-10-002-01

Precision Dimensions Measuring Apparatus

Nippon Technical Research Institute Co., Ltd. has developed a precision dimensions measuring apparatus Multimeasure with the principle of operation based on the tuning fork type contact sensor.

The tuning fork type contact sensor utilizes the principle of changing the vibrations of sound waves, and enables the inspection of products with feeble measurement pressures. The vibration changes occurring when the target object comes into contact with the sensor part are converted into digital signals, and inspection performed by analyzing the changes in the vibration characteristics with a microcomputer. The sound wave frequency is about 3 kHz.

Multimeasure

Even the dimensions of objects of complicated shapes can be measured within an error tolerance of about 1 μm . The pressure at time of measurement can also be suppressed to about 1 mg, so there is no hazard of the target objects being deformed. The measuring apparatus can also be incorporated in the inspection process of a production line as a jig.

Multimeasure has a size of (L)40 x (D)20 x (H)20 cm, and is sold at a domestic price of ¥1 million/set.

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97-10-002-02

Reduced Potential Riseup Time of Gbit Class DRAMs

NEC Corp. has established a technology to sharply reduce the poten-

tial riseup time of 4-16 Gbit class DRAMs, of which commercialization is anticipated in the 21st century, to only a fraction compared with those of DRAMs manufactured by other technologies. The new technology is based on changing the electrode material of the capacitor (memory element) from the usual polysilicon to a metal, by which large-scale integration and acceleration of memory storage are achieved at the same time.

The capacitor electric charge is proportional to the area of the counterfacing electrode and inversely proportional to the distance between the two electrodes, so this distance is made as small as possible according to the technical limit. However, with large-scale integration, the capacitor area must be as small as possible, and improvements have also been made in the electrode materials.

With polycrystalline silicon used previously, surplus electric charges are accumulated inside, so an oxide film is generated between the capacitor electrodes in the process of manufacture, so that the distance is larger by that extent. The company shortened the distance between electrodes by using a metal (tungsten) in place of polycrystalline silicon, and increased the area by processing the metal into a cylindrical form. This allowed adequate capacitance even with DRAMs of over 4 Gbit class.

A metal with lower electrical resistance was used at the contact between the capacitor and the power unit, which shortened the time for electric charge input and output. Therefore, with 4-16 Gbit DRAMs, the potential riseup time has been shortened to 2.0-2.5 ns, only a fraction compared with DRAMs manufactured by conventional processes.

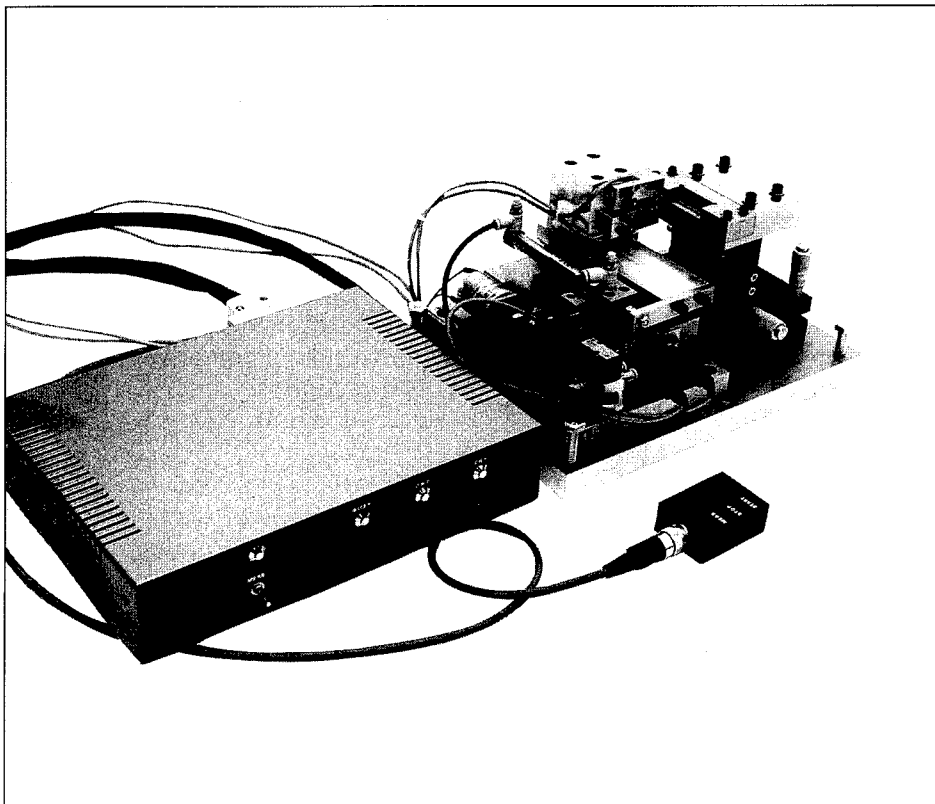
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Machinery & Mechatronics

97-10-003-01

Feeder for High-Efficiency Notching Presses

Shinohara Press Service Co., Ltd. has developed a feeder NF-100 for incorporation into notching presses. The machining position matching method has been changed to enable the preparation time to be shortened considerably, the system has been made lightweight, and the tact time shortened to 7 sec, about 3 sec shorter than conventional systems.

Normally, the feeder line is adjusted to match the machining position at die changing, but the new system is designed for fine adjustment by adjusting the press itself, so the work of preparation changing has been eased considerably.

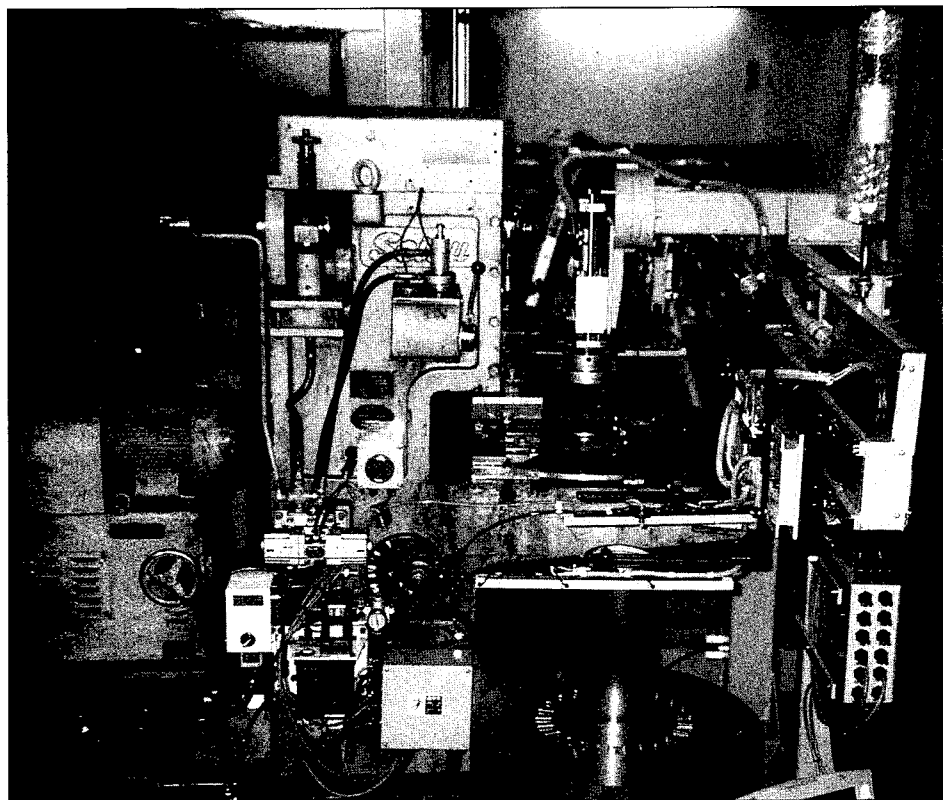
This feeder uses vacuum action to lift up the cores of large motors from the stocker one by one for notching, transfers them by fixation on a magnetic chuck, and feeds them to the

press. Subsequent to machining (notching), the cores are retrieved from the magnetic chuck. When lifting up, the cores are detected with two or more sensors, and the sucking system incorporates a function to re-suck in the event no core was lifted up.

The cores which can be handled have thicknesses of 0.5-0.7 mm, outerdiameter of 350-750 mm and interdiameter of outerdiameter of 140-290 mm. The feeder can be mounted on existing presses, and can be designed in conformance with the state of the working environment and the size of the press.

The feeder is marketed at a domestic price of ¥10-25 million per line, depending on its specifications.

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273
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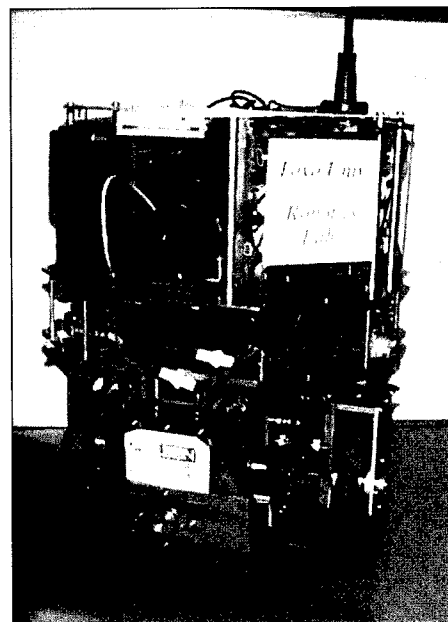


NF-100

97-10-003-02

Self-contained Autonomous Robot for Maintenance Work

Assoc. Prof. Dr. A. Matsumoto of the Department of Mechanical Engineering, Faculty of Engineering, Toyo University, and the Institute of Physical and Chemical Research, have jointly developed a self-contained autonomous maintenance robot that moves about while judging the state of the surrounding environment.



Self-contained Autonomous Robot

The robot is circular with a diameter of 45 cm and height of 70 cm, and moves about forward and backward, left and right without changing its orientation, with a special type of mobility mechanism using multiple wheels in combination. It uses 12 ultrasonic sensors to avoid obstacles and runs slowly at a speed of 20-30 cm/s.

The robot incorporates a camera and an image processing board. The surrounding state is captured with the camera, the images processed within about 1 sec, and the next action is taken. It can discriminate specific red and green colors, so utilizes colored marks to perform complicated motions without requiring a map of the surrounding area.

It also incorporates a communications function and can maintain liaison with other robots, and engage in coordinated tasks. The research team plans to use multiple robots in combination for use in maintenance operations.

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97-10-003-03

Ball Bearings Made of Antibacterial Plastics Iupital-RV-21

TOK Bearing Co., Ltd. and Prof. N. Tsukamoto of the Faculty of Engineering, Chiba University of Technology, have jointly developed a roller bearing made of antibacterial plastics.

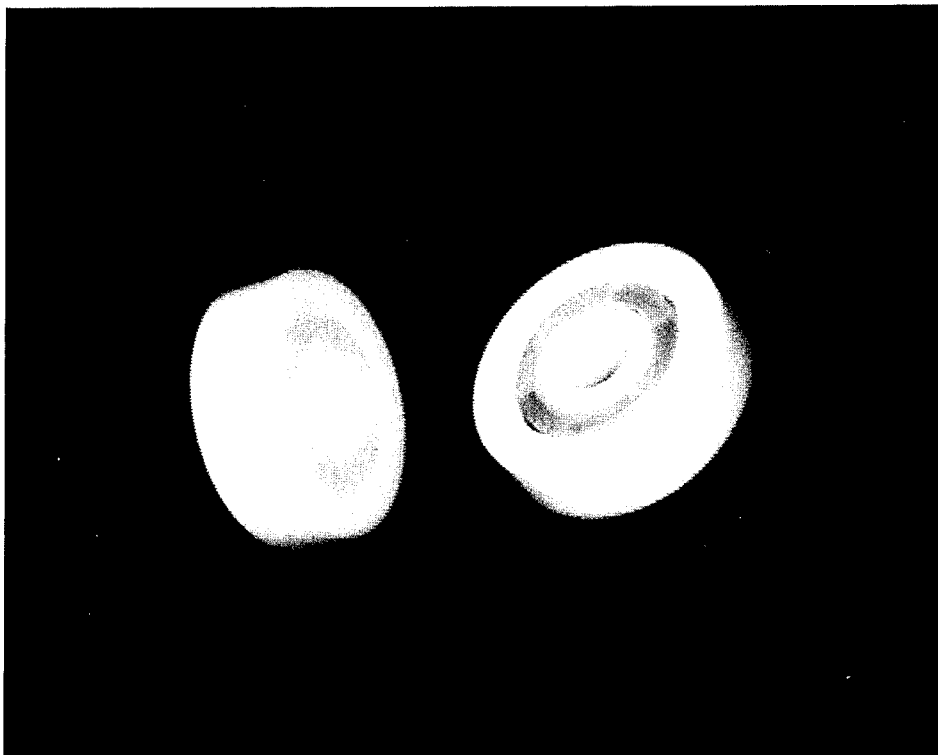
The new ball bearing is made of an antibacterial plastic Iupital RV-21. Plastic materials have extremely high molding fluidity, so maintaining the accuracy of ball bearings made of plastics is regarded as quite

difficult, but the research team optimized the dies and post-injection molding process, by which the friction coefficient and load-bearing capacity of the new bearing was improved to the about the same level as that of conventional polyacetal ball bearings.

Iupital RV-21 is produced by mixing a few percent of inorganic antibacterial material into polyacetal. Antibacterial performance tests of the polyacetal Iupital F20-30 of standard grade showed that the number of E. coli in the material, initially 300,000, increased after 24 hrs to 660,000, and likewise the number of yellow staphylococci increased from 68,000 to 80,000. By contrast, with RV-21, both these bacteria were reduced to zero, making the bearing bacteria-free. The company has also acquired a bright outlook to commercialize gears made of Iupital RV-21.

*** TOK Bearing Co., Ltd.**

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Iupital RV-21

97-10-003-04

Robot for Welding Curved Outside Plates of Ships

Hitachi Zosen Corp. and Nittetsu Welding Industry Co., Ltd. have jointly developed a new type of welding robot that automatically welds the curved outside plates of ships sequentially from one side, and Hitachi Zosen has installed a new line incorporating the robot in its Ariake Dock in Nagasu Town, Kumamoto Prefecture. The outside plate curvature is sensed in three dimensions with sensors, and the outside plates, whose curvatures change continuously by up to an angle of 15 degrees, are welded automatically.



New type of welding robot

The size of the outside plates which can be welded with the new welding line using the robot is (L)20 m x (W)15 m x (T)11-22 mm, so virtually all outside plates used in shipbuilding can be handled.

The introduction of the new welding line enables the 8 hrs required previously for continuously welding ship blocks including curved plates to be shortened to 4 hrs. Also, previously, about 7-8 workers had been necessary for welding curved plates, but the robot now enables this task to be accomplished with two workers.

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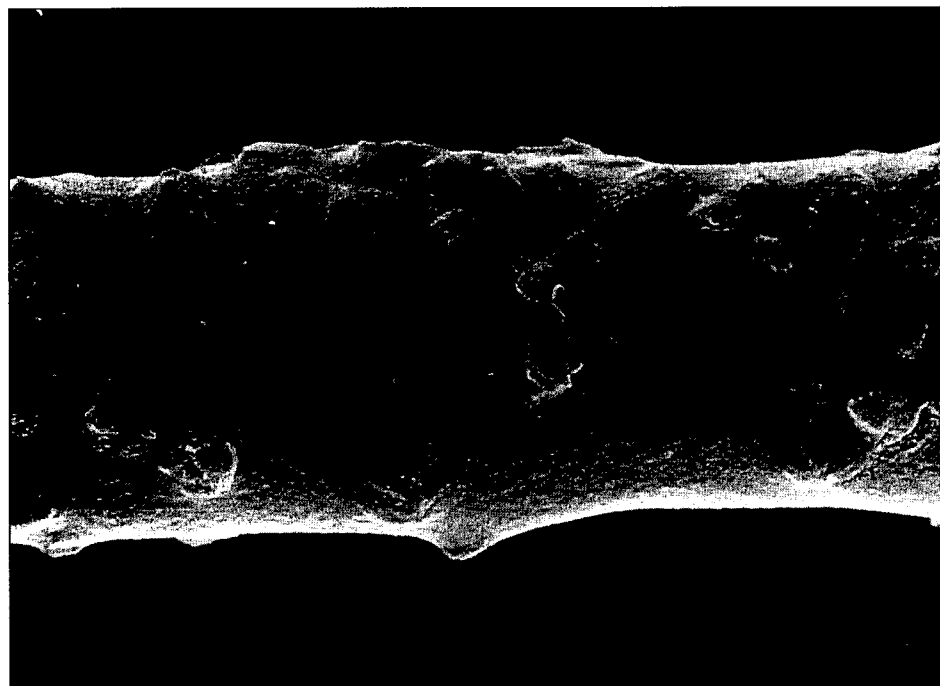
97-10-003-05

Precision Wire Saw

Osaka Diamond Industry Co., Ltd. has developed a precision wire saw (PWS) that uses a high strength core wire with resin bonded diamond abrasives fixed around the circumference, and has started distributing samples of the wire saw. A fixed number of abrasives constantly come into contact with the sawing surface, so the sawing accuracy is improved substantially. A chip pocket is also available that constantly collects the chips, so the cutting edge is not

The saw is sold at a domestic price of several hundred yen per meter. Core wire mass production will lower the price to a few dozen yen per meter. The diameter of a standard type of wire saw is about 0.2 mm, but wire saws of other specifications can also be produced to meet user needs.

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Precision wire saw

loaded and the working efficiency is also improved.

Water is used as the coolant when sawing, which prevents dust generation and improves the working environment, also makes cleaning unnecessary when engaging in subsequent machining operations. The precision wire saw has a wide range of applications, such as working with semiconductor silicon ingots, solar cell silicon ingots, also glass and magnetic materials.

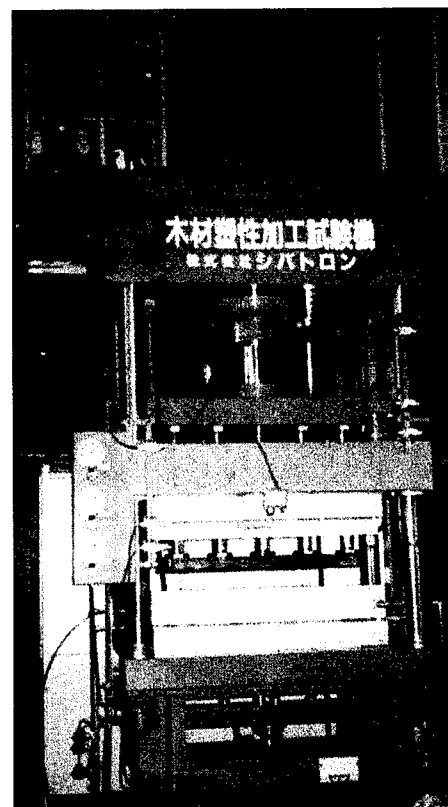
97-10-003-06

Poor Quality Wood Improved to Aluminum Level Strength

The Industrial Research Institute of Niigata Prefecture has developed wood compression technology to improve mechanically poor quality wood to aluminum level strength wood by compressing and setting. Higher strength compressed wood was produced in the laboratory with a specially designed hot press from the mechanically poor quality wood by the combination of hot pressing and steaming.

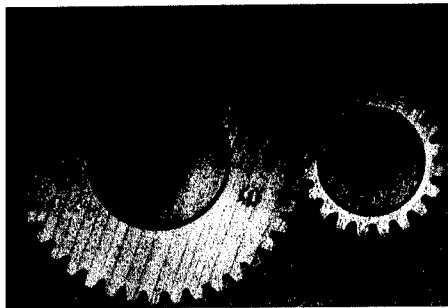
Wood from both softwood and hardwood species with a low density of below 0.5g/cm³, for example Japanese cedar (*Cryptomeria japonica* D. Don), Sitka spruce (*Picea sitchensis* Carr.), Douglas fir (*Picea douglasii* Carr.), Hohnoki (*Magnolia obovata* Thumb.) and Sawagurumi (*Pterocarya rhoifolia* Sieb. et Zucc) were used as the raw material.

Higher strength compressed wood was produced by a specially designed hot press. Wood with a maximum thickness of 110mm was compressed to about 30% (maximum) of the original thickness at 180°C and steaming for about 15 minutes for setting.



Specially designed hot press

Compressed wood prepared by such methods are known to resist recovery to the original dimensions. However, since no chemicals are used for the setting after compression, the resultant products are a safe and stable ecomaterial. The compressed wood with density of 1.0–1.1 has improved mechanical properties and workability comparable with the original wood with density of 0.3–0.5. The improved



Wooden Gears
(*Magnolia obovata* Thunb.)

mechanical properties include bending strength, compression strength, surface hardness and pull resistance of screws. In addition, the tone of color was improved the deeper colors than those of the original wood. The new color tones also added

solid character to the wood. This will help the development of new wood products of higher quality.

The compressed woods were used for determination of mechanical properties and for trial production of various new products such as wooden gears, precision parts, wooden slender handrails, functional wood sashes, wooden chairs with slender legs, high insulation wood tools, thresholds with high surface hardness, etc.

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performances to minimize the load on CPUs. Real-time decoding simply with software, thus eliminating the need for an expensive decoder chip, enables dynamic images to be enjoyed as in television broadcasting. At present, the loads imposed by the newly developed software is 75% by the video decoder and 6% by the audio decoder, or a total of 81%.

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Information & Communications

97-10-004-01 Software MPEG2 Decoder

NEC Corp. has developed a software MPEG2 (Motion Picture Expert Group 2) decoder that enables dynamic images and audio signals to be decoded and reproduced in real time simply with personal computer software at a high quality comparable to that of television broadcasting. The new decoder was developed for use in Intel Corp.'s MMX Pentium environment, and an algorithm was developed that enables the parallel processing function characteristic of MMX to be utilized fully, by which real time decoding simply with software has become possible for the first time. There is no need to rely on expensive hardware, and quality dynamic images can be reproduced.

The new software is operable on a personal computer mounting an MMX Pentium working at a processor frequency of over 266 MHz. Audio signals compressed with MPEG2

as well as audio signals compressed with MPEG1/audio can be decoded. The high-speed algorithm is applicable to the compression functions of MPEG2, or indiscrete cosine transformation and arithmetic compensation by matrix calculation which are used by MPEG2. An algorithm was also developed that enables parallel processing by coordinating the decoding and inverse quantization treatment of variable-length codes which are normally unsuitable for parallel processing. In addition, it is possible to appropriately switch over to processing routines most suitable for working with image signals, while the software method of data storage method was improved to enable decoding in real time.

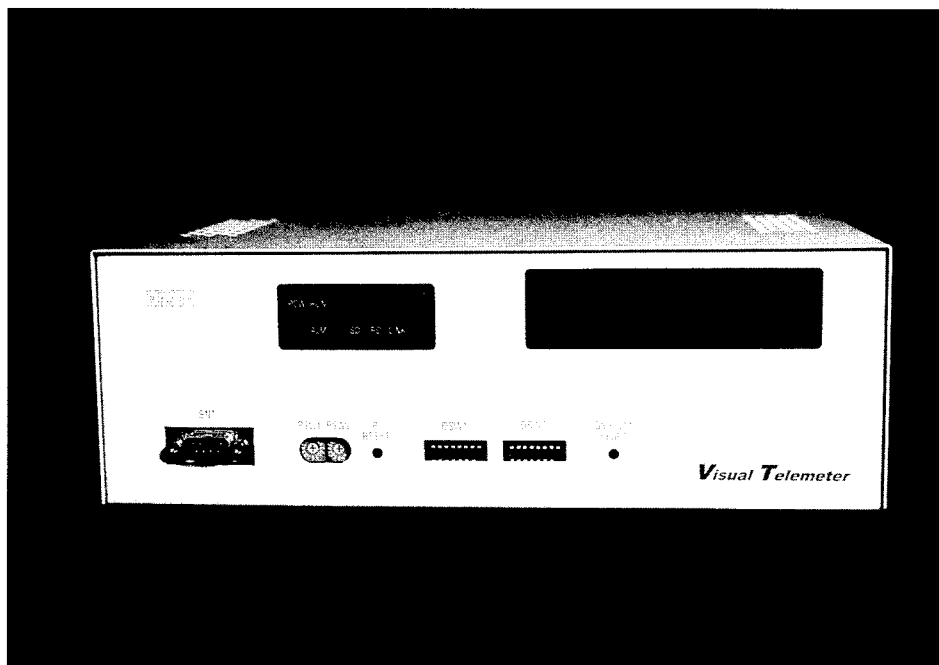
For audio signal decoding, the digital video disk (DVD) was assumed that includes image contents to enable the decoding technique to be compatible with several compression specifications. All audio decoders were designed with maximum

Hinox Co., Ltd. has developed jointly with Megaton House Co., Ltd., an industrial remote monitoring system Visual Telemeter for the remote simultaneous monitoring of images and telemetering information transmitted through public circuits or private leased circuits.

Visual Telemeter consists of a telemeter unit, a data communications unit and an image processing unit. It requires no installation of optical fiber cables and enables observation and monitoring of data and images with a personal computer through conventional transmission circuits. In addition, it can be installed at a lower cost than conventional types of industrial remote monitoring TV systems.

The system enables up to four units of cameras to be connected, and preset functions to be set up at a maximum of eight places, the JPEG image compression system is used to permit the resolution to be switched in four stages in real time, and the on-site condition-change reporting function allows transmission of data and images only when some change occurs at the monitoring site. In addition, an announcement signal is generated by the personal computer whenever there is a situation change, so there is also the advantage that

97-10-004-02 Industrial System for Remote Monitoring of Data Transmission Via Ordinary Circuits



Visual Telemeter

circuit service charges can be minimized.

Visual Telemeter, together with its software, is marketed at a domestic price of about ¥500,000 for system makers and venders. It is ideal for monitoring the states of dam water intakes, river water levels, production sites, farms, construction sites and flow of spectators.

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97-10-004-03

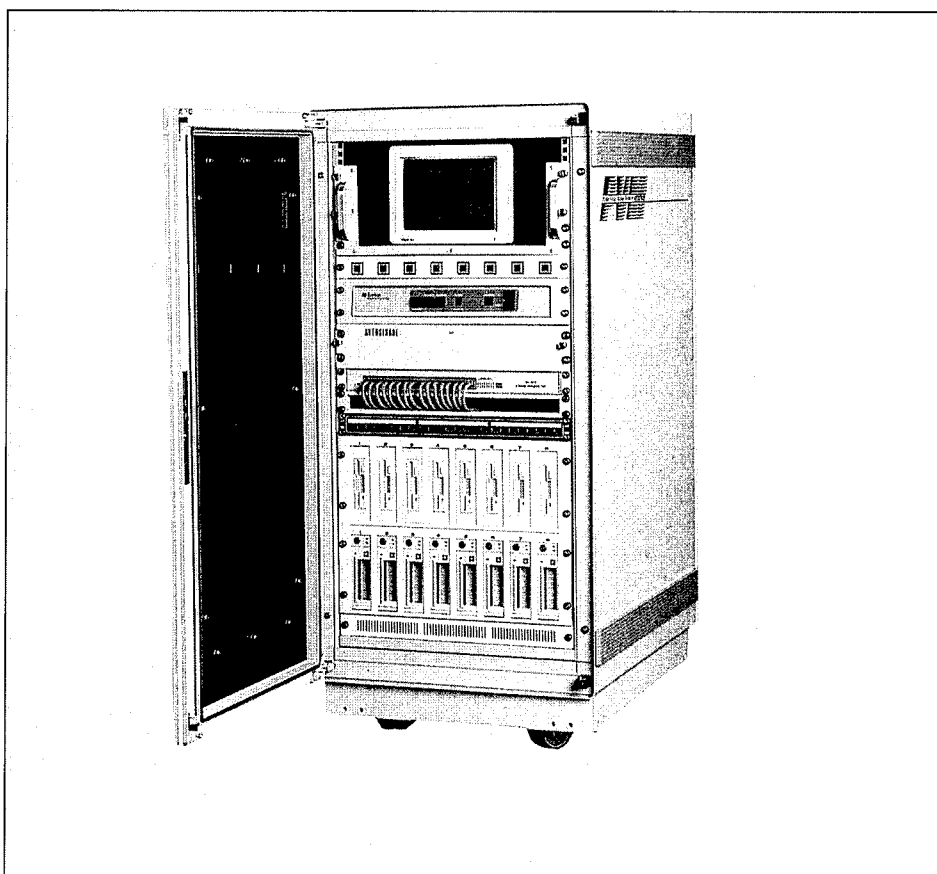
Parallel Processing Computer for Advanced Science and Technology Computations

Autostrade Co., Ltd., a computer-related technology company, has developed a parallel processing computer system enabling advanced science and technology computations for molecular design and quantum dynamics calculations.

In contrast to conventional types of high-speed, special-purpose processing systems, the new parallel processing system incorporates multiple central processing units (CPUs) to permit the computer to be used in

parallel as a computer group. Therefore, the user can select the processing capacity and processing speed in conformance with the specific need.

Parallel Processor Virtual Reality System (Parallel Virtual Machine)



For example, the type incorporating fourteen (14) CPUs can be switched to process up to 14 programs or for a processing speed of up to fourteen times.

In parallel processing, when the computer is given a processing instruction, the other computers in the system serve to assist the computer's operations. Therefore, the characteristics are not so different from those of a high-speed special purpose computer, but there is a distinct advantage that the processing time and cost can be decreased substantially.

The company is marketing various systems, from a compact system incorporating four CPUs to a large system incorporating fourteen CPUs, which range in domestic prices from ¥3 million to ¥7 million.

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97-10-004-04

Supercompact CCD Camera with Small Head of 7-mm Diameter

Elmo Co., Ltd. has marketed a supercompact charge-coupled device (CCD) camera available in the 42H Series. The head of this camera is extremely small, and that of the QN42H camera, in particular, has the world's smallest diameter of 7 mm.

These cameras are available in a wide range for use in the sectors of medical science, industrial applications and sports, and for monitoring and observations. These cameras introduce the 410,000-pixel color CCD, mount a digital signal processor, and therefore enable excellent color regeneration. They also incorporate a light measuring area selection function that enables photography with a brightness matched to the target object.

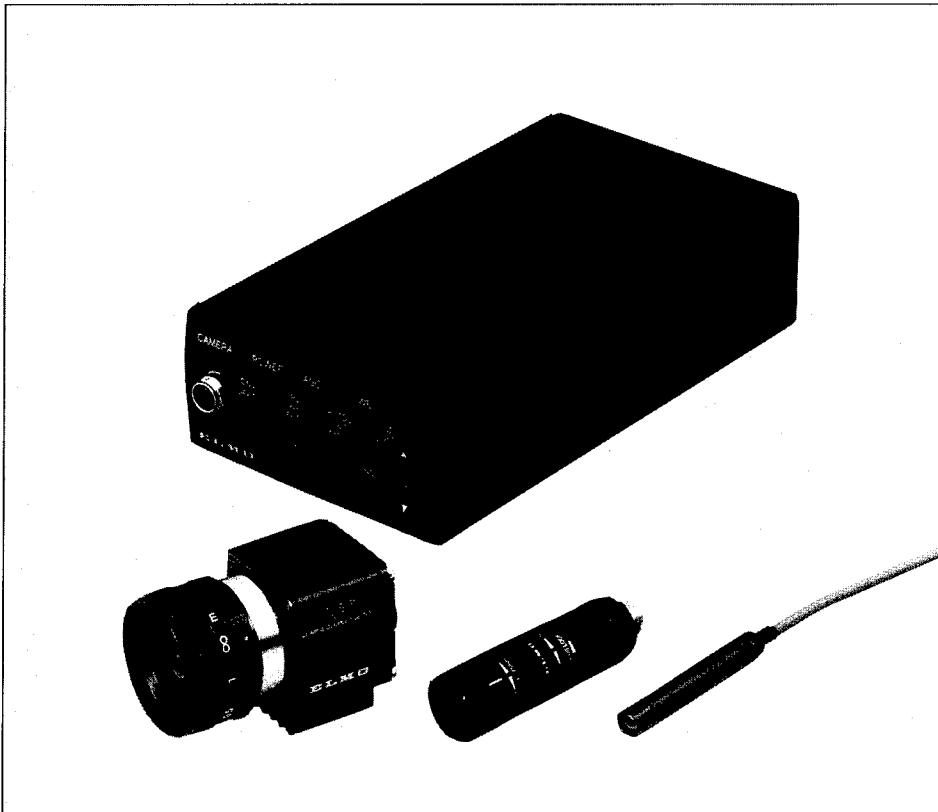
* **Elmo Co., Ltd.**

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Aichi Pref.467

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42H Series

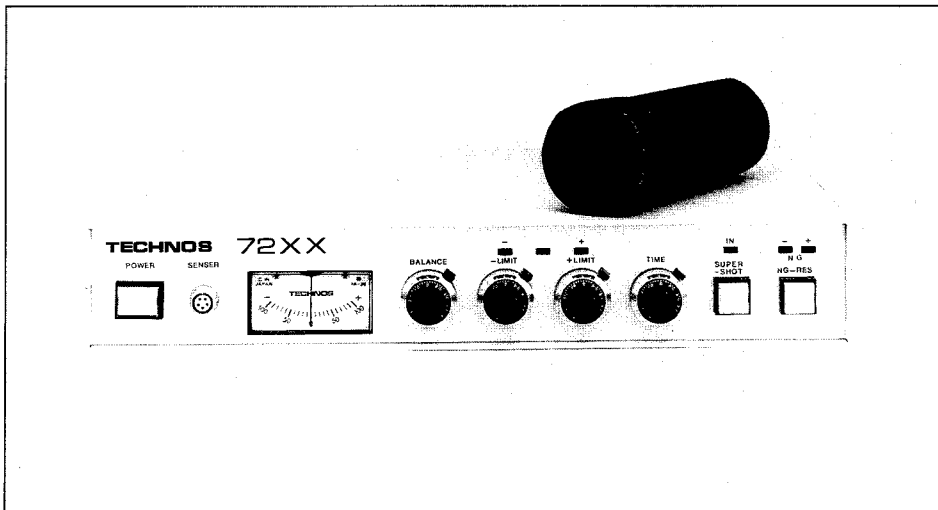


97-10-004-05

Analog Image Sensor Capable of Reading 20,000 Picture Frames/s

Technos Japan Corp. has developed a high-speed analog image sensor Technos 72XX, that can reading out as many as 20,000 picture frames/s. The sensor is usable for inspecting manufacturing superhigh-speed lines running at a speed of several thousand meters per minute.

Technos 72XX



This sensor inputs the brightnesses of various points on the picture frame which that is read out on the Z-axis, and reads out the changes in the target object shape, dimensions, luster and other conditions in the form of volumetric changes. The three-dimensional information is processed intact as analog data, so compared with the digital method of detection by dividing the target ob-

ject in fine lattice form, the information processing time is shortened substantially. The sensor is applicable to line inspections rather to detailed inspections, in which simply assessing the overall state of picture frame changes will be sufficient.

The sensor also incorporates an algorithm to investigate the correlation of target picture frames, and is not influenced by vibrations, changes in illumination with time, and the soiling of lens and illumination shades. Quantized noise is not generated since the sensor is of analog type, so it is also usable for inspecting targets of low contrast, such as the wrinkles of tires and paper.

The sensor is marketed at a domestic price of ¥963,000.

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97-10-004-06

Stereoscopic TV Requiring No Spectacles

Dr. Y. Bao of the Faculty of Engineering, Kanazawa University, has devised a three-dimensional (stereoscopic) TV that uses a liquid crystal display panel and a multifocal point lens with two focal points, so there is no need to use a special type of spectacles.

With this stereoscopic TV, two types of lenses with their focal points displaced laterally are so designed as to be mutually interswitched with each liquid crystal pixel width to comprise a multifocal-point lens and to enable different images to be transmitted separately to the left and right eyes.

Signals are input so that a separate image is generated with each pixel

width of the liquid crystal display, and a light source is placed on the rear side of the display unit, by which separate images are formed on the left and right. The multifocal point lens that is central to this system can be mass produced with ease from optical plastics or silicone.

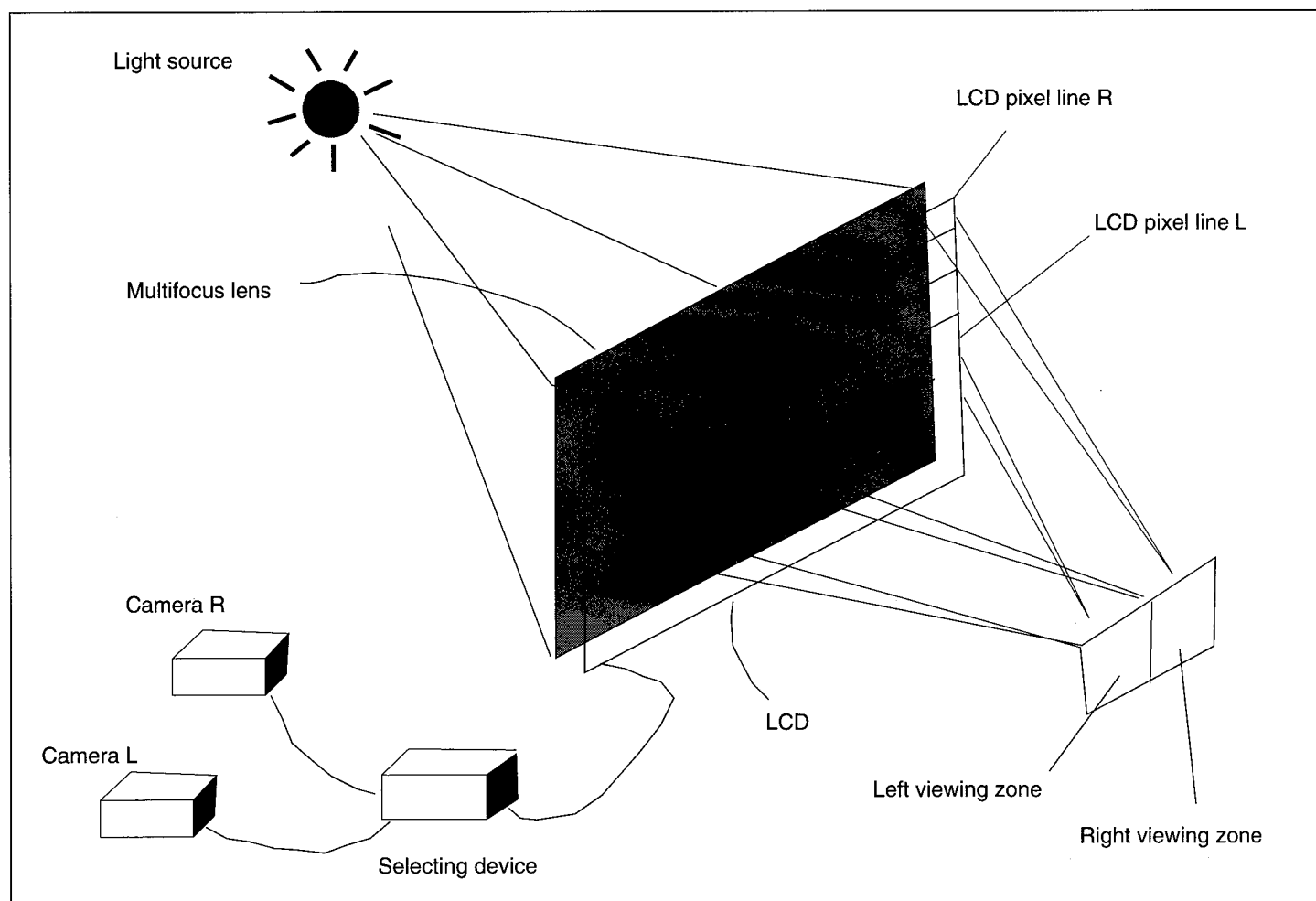
A stereoscopic TV using holographic optical elements (HOEs) has been proposed elsewhere that apporitions the visual image displayed on the liquid crystal panel to the left and right eyes using many holograms, but the newly devised stereoscopic TV system uses a multifocal-point lens by which the brightness of the images is improved substantially.

When the light source position is fixed, the head will generally have to be fixed in position at the focusing point, but if the head position is monitored with a separate video

camera and the light source position controlled and moved forward and back, left and right, or the position information provided with a remote control device, then it will be possible to transmit different images to the left and right eyes even if the observer moves. Also, by using multiple light sources, observation by multiple observers will be possible. The experimental fabrication of this system is presently under study.

Except for the mechanism for adjusting the light source position, the system components are simple, so the commercialization of this compact, convenient stereoscopic TV system is expected.

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Autostereoscopic display using multifocus lens

Process & Production Engineering

97-10-005-01

High-Temperature Thermocouple with Long Service Life

Isuzu Ceramics Research Institute Co., Ltd. has developed a high-temperature thermocouple with a long service life that is usable for measuring the temperatures of molten metal at over 1,000 °C. Previous thermocouples for molten cast iron had only been the disposable type, but the new thermocouple is usable for over 500 times. The thermocouple is an instrument indispensable for temperature measurements in the manufacturing of raw materials, machines and automobiles.

The principle of the thermocouple is to join two different kinds of metal wires in V-shape, and to measure the temperature by applying the phenomenon of a voltage generated between the two metals when the tips are heated. High-temperature thermocouples are used widely in the manufacture of raw materials and machines as well as in research and development, but the service lives were rather short since the protective tube to accommodate the thermocouple unit is deteriorated by the intense heat.

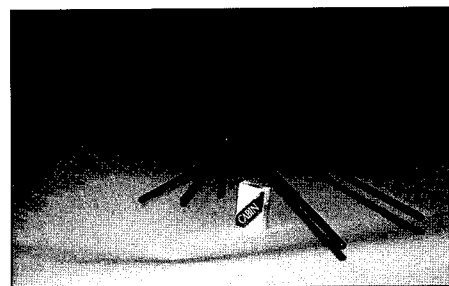
With the new thermocouple, the protective tube is made of silicon nitride ceramic featuring excellent heat resistance. Also, the metal wires are tungsten and rhenium, and the tube is filled with silicon and titanium powders, by which the sensitivity is increased and the measuring time shortened to decrease the duration of exposure to intense heat. With thermocouples for measuring the temperatures of molten cast iron, at temperatures as high as 1,500 °C, the protective tube is further covered with a ceramic material containing molybdenum. Conventional types of thermocouples for molten cast iron were disposed of each time, but the new thermocouple has been confirmed through experiments to be usable for about 500 times. The measurement of molten aluminum at about 700 °C required the thermocouple to be replaced after use for a few dozen times, but

the new thermocouple is usable for up to about 1,000 times.

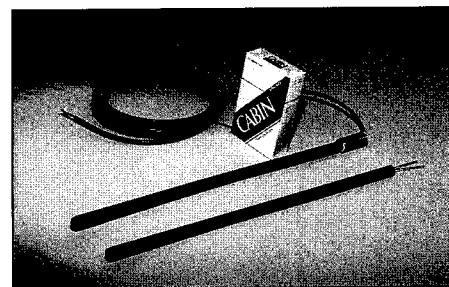
The new thermocouple is available in Type A and Type B. Type A is a ceramic thermocouple for molten cast iron. This thermocouple is usable to directly measure the surface and inside temperatures of molten cast iron. It is usable repeatedly, so the time and labor previously required to replace the thermocouple after each use is eliminated, so enabling cost reduction. The new thermocouple uses a protective tube featuring excellent heat impact resistance, so is usable directly for measuring molten cast iron without preheating, and since the metal wires are fixed in position inside the protective tube, the thermocouple is usable even in environments involving intense vibrations and shocks.

The Type B thermocouple is a high-accuracy, high-reliability type ceramic sheath thermocouple. The ceramic material is filled even inside the tip of the protective tube, so the heat is transmitted readily to provide a fast response type. The metal wires are fixed in position inside the protective tubes as with Type A, so the thermocouple is usable even in environments involving intense vibrations and shocks. The protective tube is made of silicon nitride ceramic of excellent strength, and has a construction of high durability, so is an economical type with a long service life. When used for measuring the temperatures of molten aluminum, aluminum does not adhere due to the poor reaction with silicon nitride, which translates into maintenance ease. The fixation of tungsten and rhenium wires featuring excellent thermal electromotive force at high melting points inside the sealed silicon nitride protective tube enables the thermocouple to be employed in a broad range of environments from low to high temperatures.

These two new types of thermocouples are made of expensive materials, and with the thermocouple for molten cast iron, for example, the manufacturing cost is about 500 times that of manufacturing the generic



Ceramic thermocouple for molten cast iron



High-accuracy, high-reliability type ceramic sheath thermocouple

type thermocouple. However, the replacement time is eliminated, and maintenance is easier since aluminum is not adhered on the thermocouple.

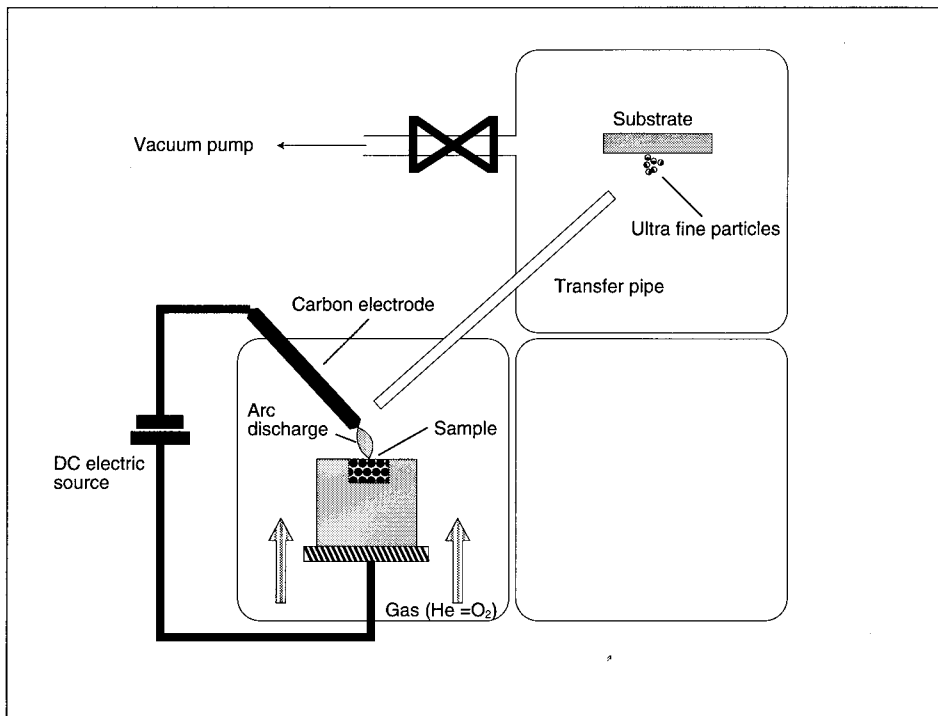
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97-10-005-02

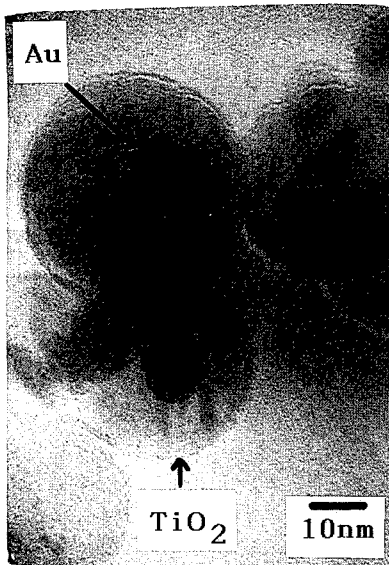
Preparation of Core Shell Type Gold-Titanium Dioxide Ultrafine Particles

The Ultrafine Particle Project Team of the Joint Research Division, Kanagawa Industrial Technology Research Institute, has succeeded in producing complex gold-titanium dioxide by the evaporation in gas atmosphere process. This complex substance features excellent sunlight absorption capacity, and has excellent thermal stability, so it may be suitable for the manufacture of catalytic materials, electronic materials for wet solar cells and materials for producing cosmetics.

Gold and titanium powders were mixed and heated by direct arc discharge in a helium gas environment containing oxygen, and the mixture of gold and titanium atoms vaporized in the helium gas at a high temperature (over 2,000 °C). The gold and tita-



Schematic image of the gas evaporation system



TEM image of gold and titanium dioxide composite ultra fine particles

nium atoms coagulated during cooling to form ultrafine particles. Titanium was oxidized to titanium dioxide and surrounded the gold. Gold, since it is inactive, concentrates at the center of the ultrafine particles during the quenching process.

Therefore, a new type of material with a core shell structure and containing gold

at the center of the titanium dioxide ultrafine particles can be formed. Moreover, the material is producible in a single process. Depending on the size of the gold particles, the complex substance is pink or blue. The diameter of the gold nucleus is 20-30 nm, and the diameter including titanium oxide 40-60 nm, although large particles of 100 nm are also available.

The new substance can absorb class A ultraviolet ray waves and therefore is applicable to the manufacture of cosmetics, and since it produces surface charge (electrons) under light irradiation, is also usable as an electromotive material for solar cells. The capability for storing electricity also allows use in producing capacitors.

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97-10-005-03 Die Production Control System

Cimx Co., Ltd. has started marketing a newly developed production control system for die manufacturing processes. The system provides integrated control of the entire manufacturing processes as well as

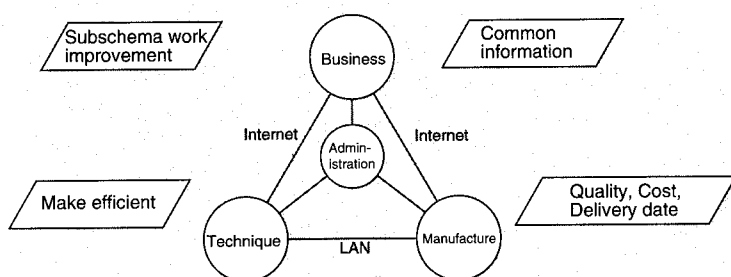
the state of work progress, and enables most efficient worker deployment and facility operation. It also permits judgement to be made immediately as to whether a rush job can be undertaken and when the manufactured products can be delivered to the client.

This advanced control system interlinks a family of personal computers installed in various parts of the plant such as at the die production site, in the design department and in the administration department together with a local area network (LAN) system, and offers process information such as work instructions and task completion reports.

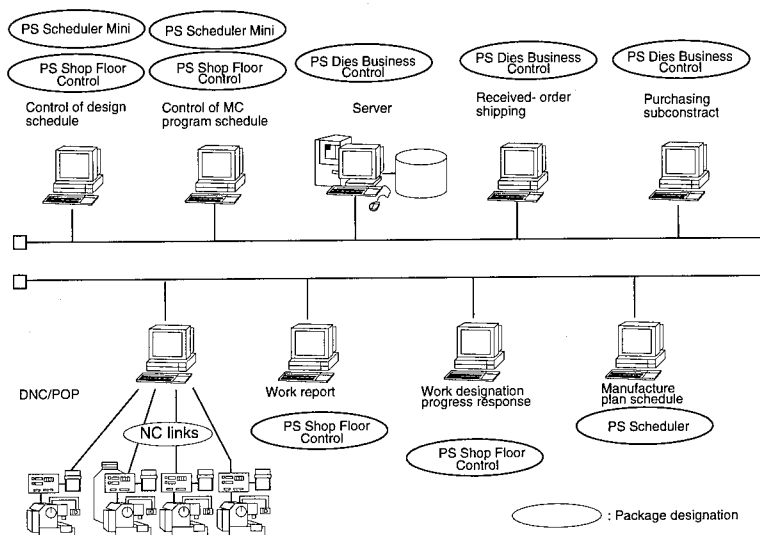
The routing data used for drafting the work schedules and work instructions are defined as standard routing, and the routing for each received order is made by extracting only the necessary parts from the standard routing data and adding necessary alterations. The routing data used in the manufacture of dies before are utilized and only the essential parts extracted and utilized with necessary alterations to draft new routing. The routing images shown on the display unit are based on the same processing instructions manuals and routing adopted for specific types of dies at the die production sites, so can be prepared with ease and understood readily by the workers.

The control system consists of a routing drafting software, a work schedule drafting software and a work progress administration software. When a die manufacturing order is received, various conditions are first input into the control system, such as the die manufacturing priority order, delivery time, current operation of the plant production facilities, work schedules of workers and other information, based on which the processing schedule is drafted. It is also possible to show the schedule by types of workers and types of production facilities and machines. Next, a work instructions manual is drafted that indicates the work procedures and the estimated hours of tasks for each die to be manufactured, and distributed to each worker. Each time a worker completes the prescribed tasks, a task completion report is input into the computer.

The plant manager determines worker deployment and the method for various



Die CIM concept



Die CIM layout

machines while looking at the state of advancement of various work, and reschedules the production plan whenever necessary. The new control system provides information readily as to which workers can be assigned to specific production tasks even if some rush job comes in.

Dies are manufactured to order and cannot be prepared beforehand and stored. Therefore, the production plans normally have to be altered rapidly in conformance with the progress of manufacturing schedules to maintain a high level of plant productivity. It is also difficult to accurately inform the client when the ordered dies will be completed. However, introducing the new system will solve these problems.

The Dies CIM system provides an integrated methodology for all operations from order reception to product ship out with the following packages:

PS Dies Production Data Control: Control of received-order data and routing data.

PS Scheduler: Establishment of manufacturing schedule.

PS Scheduler Mini: Establishment of basic production plan and design plan.

PS Shop Floor Control: Control of work progress.

PS Dies Business Control: Control of purchasing, subcontract and production costs.

PS Efficiency Control: Operation rate and efficiency control.

NC Links: System for DNC operation of machine tools.

The system is marketed at a domestic price of ¥6-7 million depending on its specifications. In addition, a client is required to pay 5% of the selling price as an annual maintenance charge.

* **Cimx Co., Ltd.**

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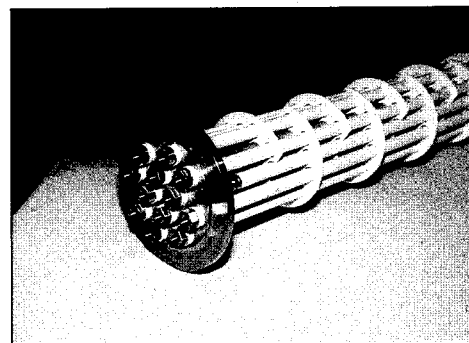
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97-10-005-04

Separation System Using High-Performance Ceramic PV Membrane

Mitsui Engineering and Shipbuilding Co., Ltd. has developed a separation system (PV Separator) using a high-performance ceramic pervaporation (PV) membrane, which is the first such system using a PV membrane made of ceramics.

The new system enables dehydration of special types of solvents such as dimethyl formamide (DMF) which had been difficult to treat with polymer membranes, and permits effective recovery and reutilization of isopropyl alcohol (IPA) that is used for washing semiconductors and liquid crystal components.



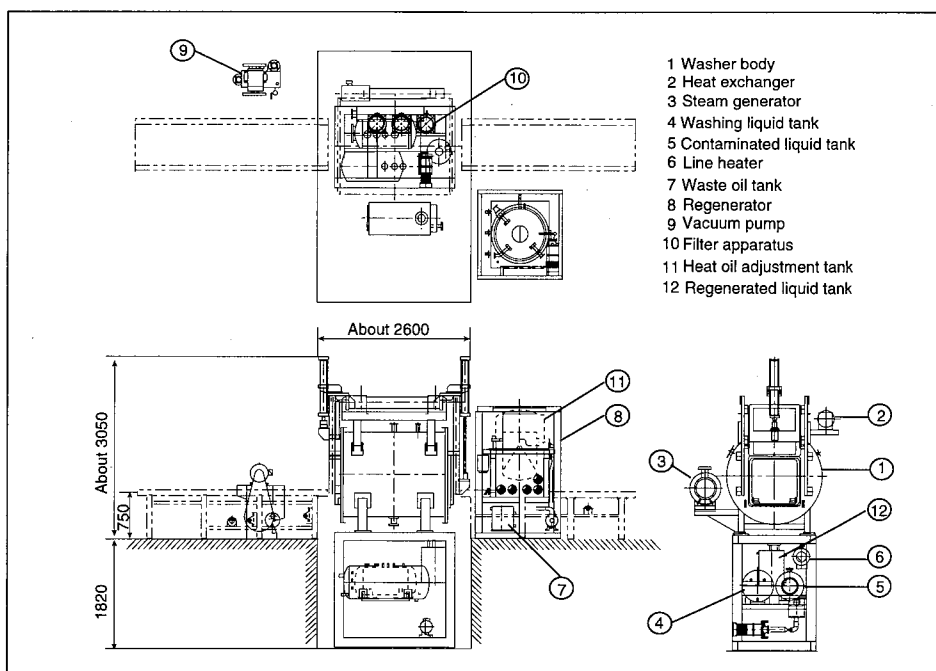
PV Separator

The company succeeded in the industrial manufacture of the membrane by applying the results of research conducted by Prof. K. Okamoto and his research team of the Faculty of Engineering, Yamaguchi University. The PV Separator is used to dehydrate and regenerate ethanol that is used to extract vitamins and antibiotic substances, and for dehydration and concentration of organic solvents.

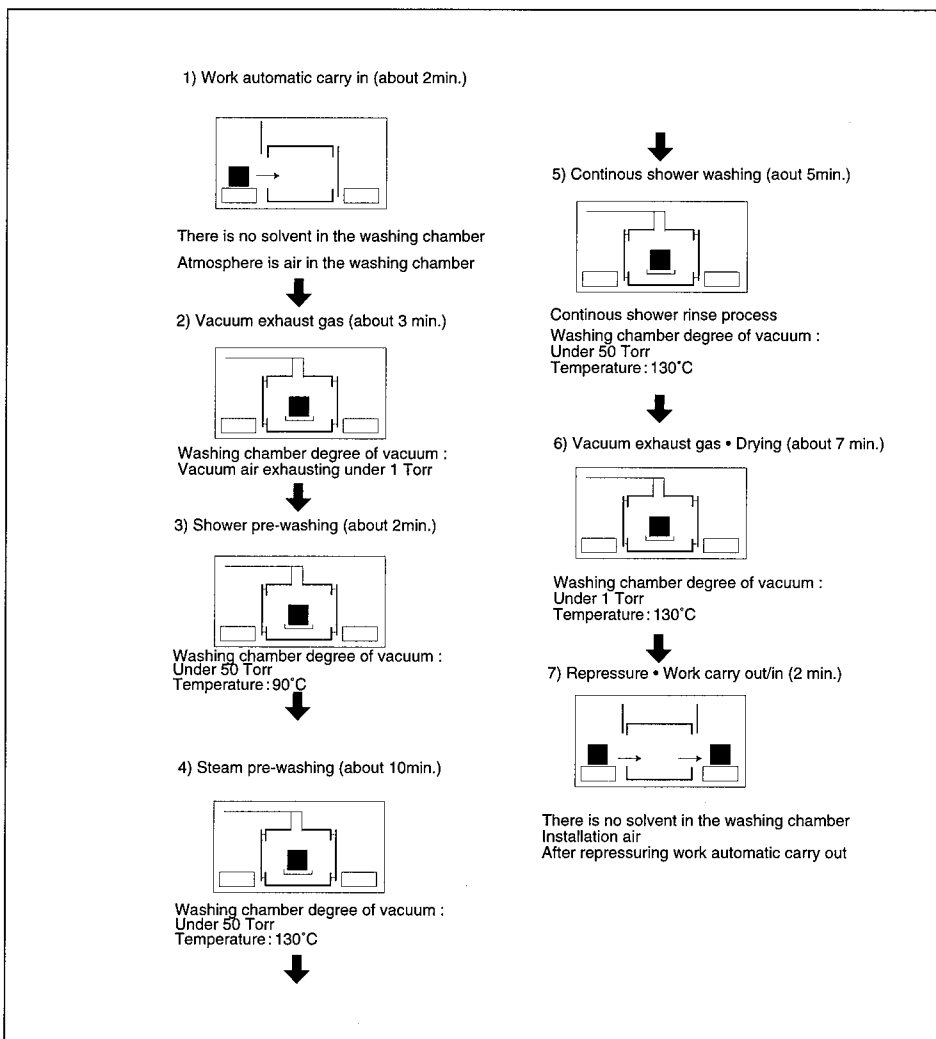
The ceramic PV Separator features excellent heat resistance and is usable at temperatures of over 100 °C. It is resistant to virtu-

ally all types of organic solvents, and features an excellent dehydration performance that is 5-10 times that of polymer membranes when working with ethanol or IPA. It also has a high performance as a vapor permeation membrane, and is therefore usable not only for dehydrating mixed liquids but also mixed vapors. The ceramic PV membrane module is the tubular type and, compared with flat membrane modules made of conventional types of polymer membranes, is compact and light, and can therefore be handled with ease. The module is available in standard membranes with areas of up to about 10 m², so a membrane of suitable size can be used conveniently depending on specifications such as the treatment volume.

The PV Separator is marketed at domestic prices from ¥20 million, depending on its specifications.



Construction drawing



Washing process flow

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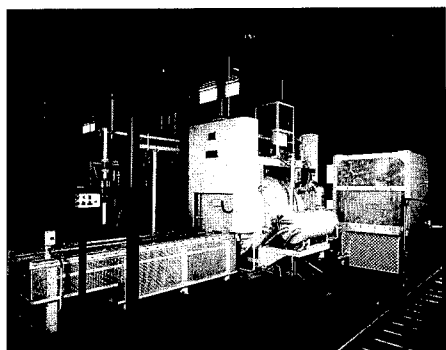
97-10-005-05

High-Performance Vacuum Degreasing/Washing System

CCI Co., Ltd., jointly with Motokubo Machining Works Co., Ltd. and Fukuyama Heat Treatment Industrial Co., Ltd., has started marketing a high-performance vacuum degreasing/washing system using a hydrocarbon solvent, and a vacuum solvent regeneration system. The closed vacuum degreasing/washing system features superlative washing quality, facility maintenance and safe system operation, which are required in heat treatment processes.

The system uses a petroleum-based hydrocarbon that is non-polluting, and the washing and drying processes are operated continuously, forming a space conserving, single-chamber type closed washing and drying system. Subsequent to vacuum depressurizing, the various washing modes such as shower washing, steam washing and continuous shower washing modes can be selected flexibly depending on the necessary degree of washing. Since the washing and drying processes are accomplished

in a closed chamber in vacuum state, the entire system is quite compact, carrying out quick drying and preserving safety from fire.



High-performance vacuum degreasing/washing system

In the standard washing cycle, shower washing using heated solvent is performed by using showering nozzles provided at various spots inside the washing chamber. Meanwhile, preliminary washing is performed with steam jetted from the upper and lower parts of the washing chamber to melt and remove oil and particle adhesions by over 95%, after which the contaminated solvent (about 80 liters) is completely recovered in a preliminary-washing contaminated liquid tank. Next, a detergent (about 450 liters) is fed into the closed washing liquid circulation circuit, and compound high-pressure shower/steam washing is performed using the high-performance detergent in a closed washing environment, by which excellent washing is accomplished through permeation washing.

The contaminated washing liquid is entirely recovered in a washing liquid storage tank maintained in a depressurized state to prevent solvent oxidation. At the bottom part of the washing chamber are heaters (for heating medium oil), and a roller conveyor system is installed for the washing target feed in and take out. The washing/drying chamber outer shell, the shower liquid tank and the steam generation system are heated indirectly with circulating oil controlled to the temperatures prescribed for the respective facilities, and the oil content in the vacuum exhaust gas is liquefied and recovered by virtually 100% with a water-cooled heat exchanger, solvent collector and oil mist trap.

The solvent recycling ratio is also virtually 100%, which enables complete reutilization of the detergent featuring a high level of degreasing /washing performance. The basket size is (L)1,220 × (W)650 × (H) 600 mm, and the treatment target weight 650 kg. The washing time per charge is 20-40 min in fully automatic operation. The system is marketed at a domestic price of about ¥40 million, in a set with a vacuum solvent regeneration system with a capacity of about 300 liters/hr.

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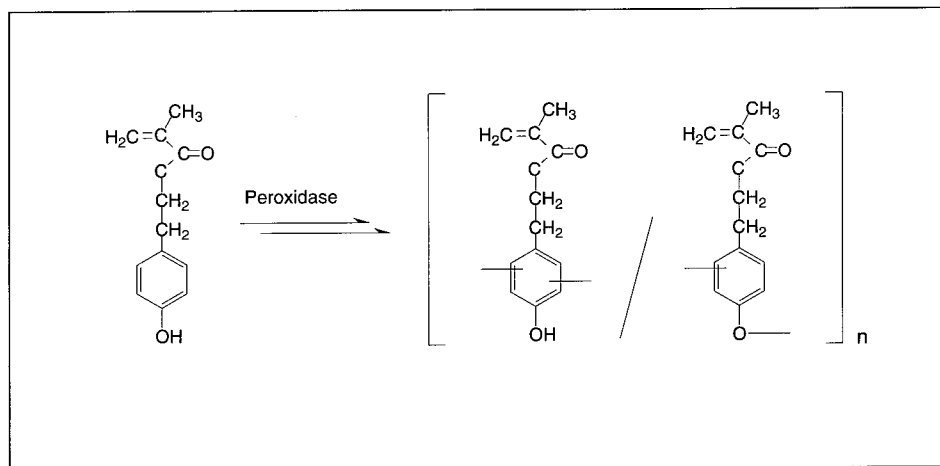
Synthesis of Environmentally Harmonized Polyphenol Resin Using Enzymatic Catalyst

The Enzymatic Polymerization Group (R&D of Multi-Dimensional Polymer structures lead by Prof. S. Kobayashi of Kyoto University) is advancing a project entitled Technology for High-Functional Materials. In this joint project of the Agency of Industrial Science and Technology, its National In-

The peroxidase present in horseradish and soybean was used as the catalyst to polymerize a phenol monomer with methacryl groups, to obtain the product at a high yield. In this polymerization process, the enzyme selectively recognizes only phenol radicals from the two functional groups of phenol and methacryl in the monomers.

Conventional polymerization techniques had been regarded as unsuitable for selective polymerization of monomers containing highly reactive functional groups in side chains such as unsaturated groups, but usage of the specific enzymatic catalyst made it possible to synthesize polyphenol containing methacryl groups, for the first time. This new technology eliminates the usage of toxic substances which are employed in the conventional processes of synthesizing phenol-based resins, therefore it may be regarded as a new environmentally harmonized polyphenol synthesis process.

The hardening temperature of this new polymer is as low as 100 °C, which makes it suitable for low-temperature thermosetting resin application. It can also undergo photocrosslinking, so is expected to be useful as a new negative type photoresist.



Synthesis of polyphenol resin using enzymatic catalyst

stitute of Materials and Chemical Research, and Japan High Polymer Center, an enzymatic polymerization process was applied to synthesize polyphenol with methacryl groups in side chains.

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Construction & Transportation

97-10-006-01

Energy Conservation and Environmentally Gentle Hybrid Dump Truck

Obayashi Corp. and Tomoe Electrical Machinery Industry Co., Ltd. have jointly commercialized a Hybrid Dump Truck featuring energy conservation which is gentle to the environment. The electrically powered truck uses a diesel engine for power generation, and the power is stored in storage batteries to work the motors when running the truck. Compared with diesel engines available on the market, the engine is much smaller and the emission of nitrogen oxides (NOx), carbon monoxide and other toxic gases is reduced to about one-fourth.

This new hybrid dump truck features a rational output design. When the power generation system is in operation, it constantly generates electricity at a constant level, and when surplus power is gener-

ated as when the truck comes to standstill or stops engaging in cargo loading and unloading operations, the surplus electricity is stored in storage batteries. Demonstration tests confirmed that the power normally necessary for operations was conserved by about 30%.

These trucks mount a diesel power generator, a DC motor and storage batteries, and may be regarded as a remodeled electric vehicle. The truck was designed for use in earth loading and unloading operations in tunnel excavation projects, and the other functions are exactly the same as those of trucks available on the market. The engine has a displacement of 1,955 cm³ that is less than one-half that of ordinary 2-t trucks, and there are ten storage batteries each weighing 10 kg.

This is the first hybrid dump truck of this type, and is being used in the Karato No. 1 Engineering District (East) Tunnel Construction Project in progress in Kitaku, Kobe City. The present truck is a 2-t

version, but larger trucks of 12 t and 20 t will be built for use in tunnel construction projects. Tomoe Electrical Machinery Industrial Co., Ltd. will be accepting orders for the hybrid dump trucks.

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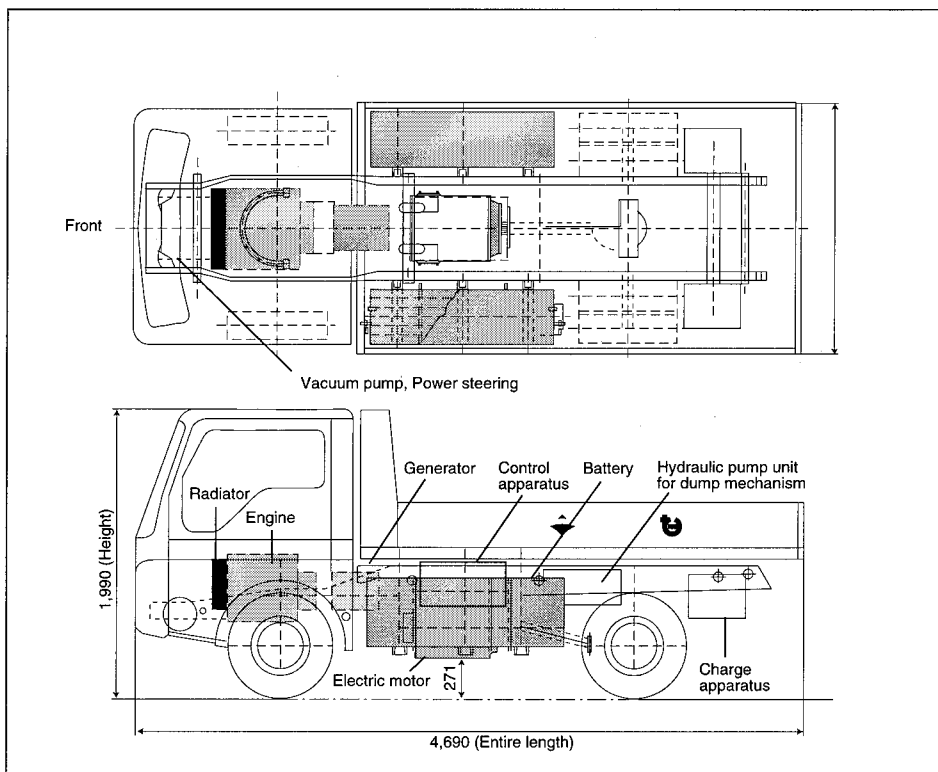
Excavated Earth Discharging Machine Enabling Digging and Discharge in Restricted Spaces

Fujita Corp. and Hitachi Construction Co., Ltd. have jointly developed an excavated earth discharging machine available in two models which facilitates the work of digging and excavated earth discharge when working in narrow spaces as when engaging in subway construction projects. The machine performance was demonstrated in June this year in a civil engineering project advanced in Kanagawa Prefecture.

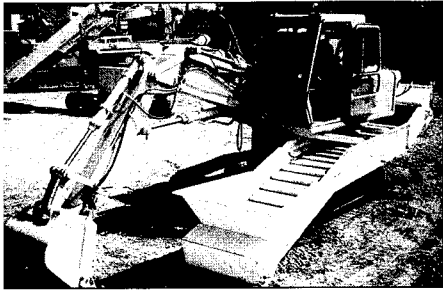
The new machines consist of a hydraulic shovel Horu-do (Excavator) equipped with conveyor and a conveyor vehicle Okuru-do (Discharger). The Excavator is a hydraulic shovel combining a conveyor, and the excavated earth filled into hoppers fitted on the conveyor tip is discharged outside from its rear part. Therefore, there is no need for slewing as with conventional types of hydraulic shovels, so it is usable for working in narrow places. The earth conveyance capacity is 60 m³/hr, and the conveyor is 7m long.

The earth dug with buckets is transferred to the rear and discharged without having to slew the hydraulic shovel. This has the advantage of reducing the danger to workers who normally engage in ground leveling subsequent to digging. There is also less probability of the hydraulic shovel coming into contact with the pillars, beams and ceilings of subway tunnels.

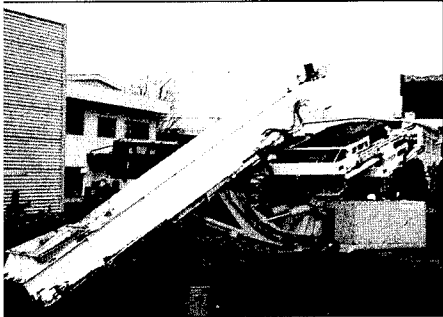
The Discharger is equipped with two conveyors, one in the front and another in the rear. The hoppers of the front conveyor serve to receive the excavated earth fed by the Excavator, and the rear conveyor receives the earth conveyed by the front conveyor. The position for receiving the excavated earth and the location of discharg-



Block diagram



Horu-do (Excavator)



Okuru-do (Discharger)

ing the received earth of both the front and rear conveyors can be changed flexibly. The earth conveyance volume is 60 m³/hr, and each conveyor is 10 m long. The front and rear conveyors can be operated independently and enable excavated earth to be handled over a wide area. The heights can also be adjusted flexibly to permit use as a compact assembly during movement.

These machines can be manipulated with ease with a compact handy type radio operating unit that is operable from the cab of the Excavator or another excavating machine.

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97-10-006-03

Sheet Heater with Positive Temperature Coefficient

Nihon Tokushu Kogyo K.K. has developed a sheet heater with a positive temperature coefficient to rapidly reach and stabilize at a certain temperature. The heater is produced by the same technology as used in the production of printed circuits. With the overseas relocation of printed board makers, the company envisages entering the floor heater market taking advantage of the excellent features of the new heater.

The new heater has a pair of heatproof films between the heating elements and metal film electrodes are located. The heating elements are produced by printing a pattern of a semiconductor ink on one cover film, which emits a lot of far infrared radiation when supplied with power. The ink is made of carbon black and a matrix resin. At the lower temperature range, the carbon particles are so dense in the matrix that enough electric current flows through the heater elements when the heater is energized. As a consequence, the temperature of the heater rises quickly. When hot, the resin swells because of thermal expansion, and the carbon particles become more and more separate, so that the current flow drops. The ohmic heat production steeply falls, and the temperature of the heater no longer rises. When the heater is cooled down, the resistance of the elements decreases again. Vigorous heat production is restored, and the temperature rises again. Therefore, the heater has an electric resistance surging as the temperature rises. Called the positive temperature coefficient (PTC), the property allows self-control of the heater temperature so that it reaches a certain temperature soon after being turned on, and reliably remains there.

The heater is as thin as 0.2-0.5 mm (power supply terminal excluded), light, pliable, and easy to form. Operated with 5-240 V, AC or DC power, it consumes 30-55% less power than conventional plate heaters, and the safety is much greater. The most promising application is the floor heating system. The sheet heater is placed over a heat insulator layer laid under something like flooring, carpet, or tatami (a Japanese straw mat). The system will be 7 mm thick, and easily incorporated into an existing building with no requirement for adjusting the floor construction. The incorporation work is easy, and the estimated cost covering the system and installation work is about half the cost of conventional floor heaters.

The company has set up a dedicated production line with a monthly capacity of 12,000 sheets of 900 × 1,800 mm².

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97-10-006-04

Pneumatic Hub for Interswitching from Two-Wheel to Four-Wheel Drives

NTN Corp. has developed for the first time a hub enabling flexible interswitching from two-wheel drive (2 WD) to four-wheel drive (4 WD) in a part-time 4 WD vehicle operated by pneumatic pressure. Conventional types of hubs require the vehicle to stop when switching from 4WD to 2WD, but the new hub system enables switching without having to stop the vehicle, and the drive selection is performed by simple lever manipulation. In addition, the noise generated during 2 WD operation is reduced substantially.

The hub is fitted on both terminals of the constant velocity joint and serves to fix the wheel in position. The newly developed automatic pneumatic hub incorporates a movable gear sliding to left and right. A negative pressure lower than the atmospheric pressure, generated in the engine air intake, acts in the hub by pipe to move the gear to engage or disengage it from the drive side.

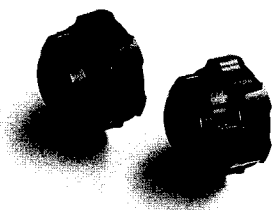
The hub is used in combination with the transfer synchronizer that matches the number of revolutions of the constant velocity joint and the drive wheel. The drive system can be changed freely even during vehicle running. No friction torque is impressed on the front wheel drive system during the change to 2 WD, so the running noise is suppressed and fuel consumption is also decreased. Pneumatic pressure is used only when switching, so only a slight burden is impressed on the engine.

A part-time 4 WD vehicle may use the system of switching the drive system with the front wheel hub, or the system that interrupts the drive power to the front wheel on the drive shaft. However, with the front wheel hub, the vehicle has to be stopped or backed up temporarily at switching, while the drive shaft system enables switching during vehicle running but the front wheel drive system will also be revolved during 2 WD operation, so the noise is considerable.

The automatic pneumatic hub enables 2 WD/4 WD switching by action of the transfer lever equipped with synchronizer regardless of whether the vehicle is run-

ning or not and without having to temporarily stop or reverse the vehicle. When the driver wants to switch to 4 WD, he only has to switch the transfer lever to 4 WD, whereupon the automatic pneumatic hub actuates and enables 4 WD. Also, when the transfer lever is switched to 2 WD, the vehicle is returned to 2 WD. In 2 WD, the automatic pneumatic hub disengages the front drive system and wheels, so the constant velocity joint and propeller shaft do not make any unnecessary revolutions.

A production system has already been established at the company's Iwata Works.



Automatic pneumatic hub

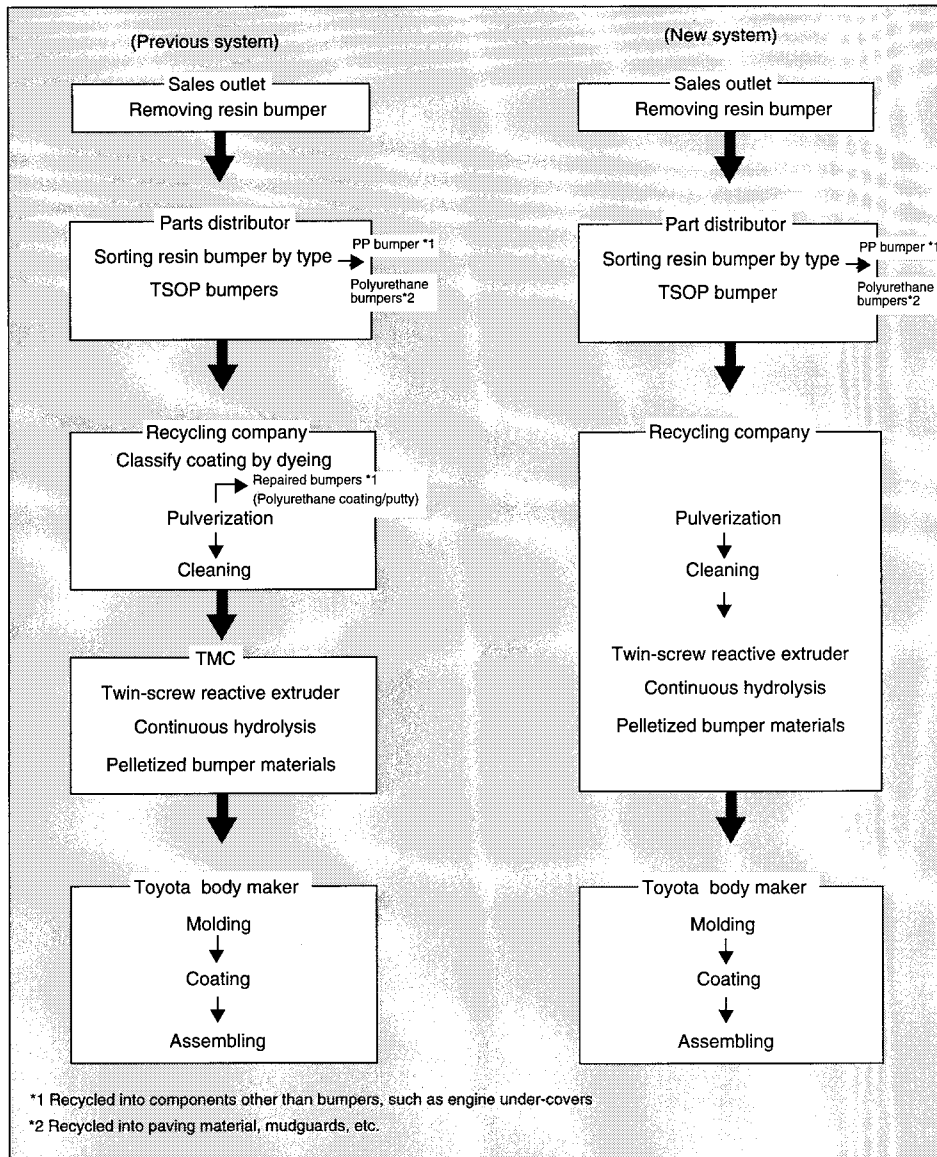
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97-10-006-05

Reutilization of Recovered Bumpers on New Vehicles

Toyota Motor Corp. has developed jointly with Toyota Central Research & Development Laboratories, Inc. a new technology for recycling repaired or repainted bumpers made of Toyota Super Olefin Polymer (TSOP). The recovered TSOP bumpers are regenerated with the same quality as newly fabricated bumpers, and recycled for new vehicles.

A new hydrolysis technology is introduced to regenerate used bumpers. The conventional hydrolysis technology is applicable only to bumpers coated with melamine, the standard coating material on ex-factory bumpers. The new technology is revolutionary in that it is also applicable



Comparison of TSOP bumper recycling programs

to putty and polyurethane coating used for repainting recovered bumpers and which have very strong molecular bonds resisting breakdown. It also makes the sorting of recovered TSOP bumpers unnecessary, as all recovered TSOP bumpers can be recycled for use on new cars.

The new technology involves three major processes. The first is the process of cleaning and pulverization of used TSOP bumpers recovered from sales outlets. The second is the process of mixing the coatings and other elements which have been melted and micro-dispersed by means of a newly developed amine-based coating decomposer and a twin-screw reactive extruder (using a special type of screw to accelerate chemical decomposition under

high-temperature, high-pressure conditions). The third is the process of continuous and mass pelletization of TSOP for recycling into usable raw materials of a quality equivalent to that of new materials.

The new bumpers are being used from mid-July on the RAV4 and Ipsum vehicles assembled at Toyota's Motomachi Plant.

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97-10-006-06

New Tool for Machining Automobile Aluminum Wheels

Sumitomo Electric Industries Ltd. has developed and started marketing a new

grinding tool that is designed to meet all the needs of machining automobile aluminum wheels.

The grinding tool blade is made of a cemented carbide alloy Igetalloy (registered trade mark) and a diamond sintered body Sumidia. The grinding tool is available in a series of tools with various shapes and is characterized by the application of a new blade treatment technology. This series features various chip shapes such as the dogbone type, 35° diamond-shaped type and round top type. A chip provided with a newly developed AW breaker features excellent cutting scrap processing effect and sharp cutting edge, while a chip introducing a special WF type blade tip shape provides excellently finished surfaces of complex shape.

The diamond sintered body is a new material called Sumidiamond DA2200 (registered trade mark) featuring defective resistances and wear resistances and enables high-speed coarse grinding, by which the machining time is shortened considerably.

The commercialization of this new series of machining tools has expanded the variation of tool materials and shapes, and enables a broad range of machining tasks to be performed from the coarse machining of outer diameter rims to the luster machining of elaborately designed surfaces, so these machining tools can now be applied to all fields of automobile aluminum wheel machining.



New grinding tool that is designed to meet all the needs of machining automobile aluminum wheels

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JETRO, October 1997

Energy & Resources

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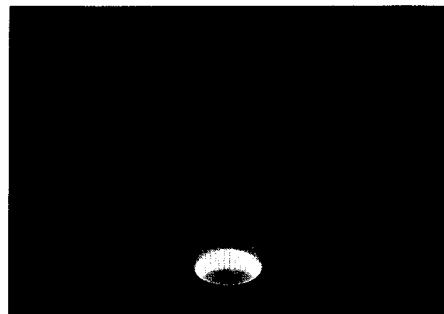
Commercial Cooking Stove Mounting Internal Multiple Frame Pore Burners with Low NOx Emission

Osaka Gas Co., Ltd., Tokyo Gas Co., Ltd. and Toho Gas Co., Ltd. have jointly marketed from July this year two types of commercial cooking stove called Table Range and Table Range for Donburi which mount a high-efficiency, low nitrogen oxide (NOx) emission type Internal Multiple Frame Pore (IMFP) burner. The Table Range for Bowl Foods is sold at a domestic price of ¥87,000, and the Table Range at ¥178,000.

The IMFP is a special type of burner whose flame rises up vertically from the burner center. When cooking, the flame spreads outward from the central part of the pot or pan, so the thermal efficiency is improved by about 10% compared with generic types of burners. The burner shape has also been improved, by which the natural primary air ratio during combustion has been improved to 70-90% compared with generic types of Bunsen burners with a suction ratio of 40-70%. As a result, the NOx emission has been reduced to 50 ppm, about 50% compared with that of the generic ones (100 ppm).

Since the flame is prevented from extending outward from the bottom parts of pots and pans, the radiation heat sensed by cooking personnel is decreased by a maximum of 25%, or the kitchen air condition is improved considerably. Also, since the flame is arranged lengthwise, the flame port are less liable to be clogged by overspills. In addition, burner head can be extracted independently for an easy maintenance.

Cooking stove for Donburi consist of three units of single-ring IMFP burners in combination. Each unit provide a thermal efficiency of 53%, higher by about 10% compared with conventional types of burners (one liter of water can be boiled in 6.5 min, about 3 min faster than conventional



Internal Multiple Frame Pore burners

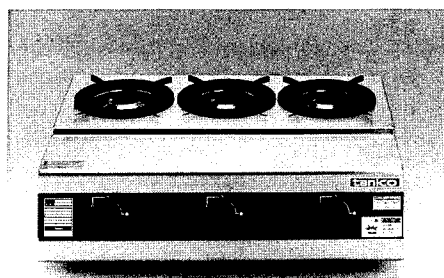


Table Range for Donburi

types of burners). The NOx emission is 48 ppm, about one-half that of a generic type Bunsen burner (about 100 ppm). Cooking stoves have a small single IMFP burner (3.60kW) and two large double ring burner (14.5 kW), large ones consist of an internal burner. Three liters of water is boiled in 9.75 min with the small ring, faster by about 3.5 min than its conventional counterparts, and its NOx emission volume is as low as 50 ppm.

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97-10-007-02

High-Temperature Superconducting Coil Attains World's Largest Energy Storage Capacity at Liquefied Nitrogen Temperature

Sumitomo Electric Industries, Ltd. and Kansai Electric Power Co., Inc. have jointly succeeded in building a prototype

high-temperature superconducting coil for superconducting magnetic energy storage that has attained the world's largest energy storage capacity of 100 J (joule).

The two companies built a prototype 100-J high-temperature superconducting coil for SMES that uses silver coated bismuth-based conductors, and conducted performance tests. As a result, it was confirmed through D.C. 34.2-A electric conduction tests that the superconducting coil, in a liquefied nitrogen environment (-196°C), can storing the world's maximum energy of 100 J (equivalent to electricity to illuminate a 100-W lamp for one second).

Up till now, the maximum storage capacity had been about 10 J, so this coil can storing ten times more energy. It was also possible to conduct AC 2-Hz electric conduction tests by simulating the operational mode of SMES. The newly developed coil can be operated with inexpensive liquefied nitrogen, so it is anticipated to decrease system running costs substantially.

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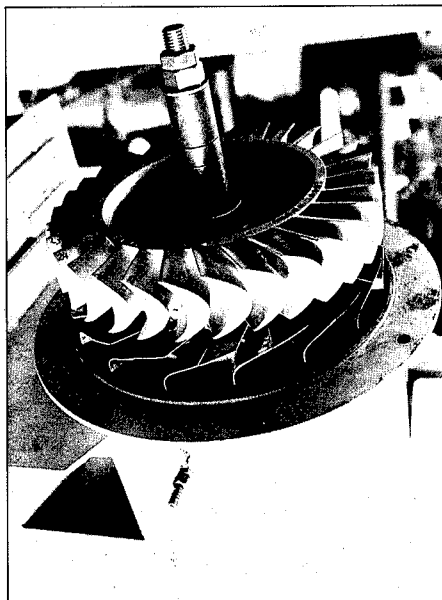
Efficient Turbine for Wave Power Conversion

Prof. T. Setoguchi and a research team at Saga University have worked out a new design of turbine for wave power conversion. The improved turbine has guide vanes with self-controlled pitch, and the new design provides a link between the upstream vanes and the downstream vanes to increase conversion efficiency. The new design has been or is being implemented in a few foreign institutes.

The turbine has a rotor with cup-shaped blades to ensure that the rotor goes round in the same direction no matter which direction the driving flow has due to changes with rises and falls of the water surface. The linked guide vanes make certain that the rotor rotates fast enough even with modest waves.

The research team estimates that the new turbine has a peak power 1.5 times as much as the Wells turbine, the conventional wave power converter. Mean out-

puts for the whole range covering lesser waves as well are calculated to achieve a higher ratio of 3.



Efficient turbine

India's National Institute of Ocean Technology will set up a 1-m diameter, turbine of the new design in the Indian Ocean to produce electricity of 50 to 100 kilowatts per hour with the actual value depending on various factors including the magnitude of waves. In China, Guangzhou Institute of Energy Conversion is building a 30-cm diameter turbine, as big as that of the research team.

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97-10-007-04

Energy Stored with High-Temperature Superconducting Coil

Kansai Electric Power Co., Inc. and Sumitomo Electric Industrial Co., Ltd. have jointly developed a high-temperature superconducting coil for superconducting magnetic energy storage (MES) systems, and succeeded in the large-scale energy storage of 100 J (electricity volume for lighting a 100-W lamp for 1 s). This has brought the SMES system a big step closer to commercialization, and since liquefied nitrogen is used for the system cooling, the system cost is lowered considerably.

Present SMES coils are made of low-temperature superconducting wires such as titanium niobate, which requires cooling with expensive liquefied helium, which had been a problem preventing the coil commercialization. The two companies established a technology to manufacture the coil with the minimal use of wires. The new coil is made of a high-temperature superconducting wire with bismuth-2223 silver sheath, and cooling uses liquefied nitrogen, so the running cost is decreased considerably.

In the coil performance tests in liquefied nitrogen, a DC current of 34.1 A was passed, and energy storage of 100 J achieved for the world's first time. Also, even in AC tests, the operation was possible without any problem with a system simulating the mode of the SMES system. The coil consists of three tape-form high-temperature superconducting wires wound in the shape of a record plate and laminated into two layers, and ten of these layers are laminated into a coil. The inductance that indicates the coil performance is 0.171 H (Henry).

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97-10-007-05

Urban Type Underground Heat Storage Tank

Nippon Steel Corp., Nikki JGC Corp. and Shimizu Corp. have jointly developed an urban type underground heat storage tank that is as long as 400 m and which is buried underground for storing thermal energy. In contrast to the pool type heat storage tank, the tank requires a minimal amount of surface ground area and the heat storage efficiency is as high as over 90%.

The developmental project was advanced jointly with the New Energy and Industrial Technology Development Organization (NEDO) and comprised a part of an R&D project that is being implemented by the Ministry of International Trade and Industry to develop a load equalization heating and cooling technology for the advanced utilization of untapped energy

resources. A compact experimental tank was fabricated in the Arakawa River basin in Okegawa City, Saitama Prefecture, in May last year, demonstration operation was conducted, and the tank was confirmed to feature a heat storage efficiency of over 90%.

In the demonstration tank construction project, a vertical hole was first dug by excavating sludge with rotary excavators. The tank body sections (assemblies with bottoms and equipped with supporting members) were next welded sequentially to the prescribed length and height, then repeatedly hoisted and installed in positions to fabricate the tank to its prescribed depth. Finally, the peripheral parts were filled with a packing material to complete the assembly. The demonstration heat storage tank construction project was advanced as scheduled and completed as rapidly as in about one month.

The heat storage tank under development by the three companies has a diameter of 6 m and total length of 400 m (capacity 10,000 m³), and is buried underground. Water is filled into the tank and heated with cheap late nighttime electricity. Since the tank is of the underground type, it features excellent heat retention, and a single tank can storing heat of 420 GJ (supply temperature of 50 °C and utilization temperature of 40 °C), or cold heat of 350 GJ (supply temperature of 7 °C and utilization temperature of 15 °C), which is an energy volume enabling the cooling and heating of a high-rise 20-story building with a floor area of over 100,000 m² for 10 hrs/day.

Nikki JGC Corp. was in charge of developing the heat storage system, Shimizu Corp. in charge of evaluating the geological and foundation thermal behaviors, and Nippon Steel Corp. in charge of the design and construction. Compared with a pool type heat storage tank, the new tank construction cost is equivalent or slightly higher, but the thermal efficiency is more than 20% higher than the 70% efficiency of the pool type, so the running cost will be less.

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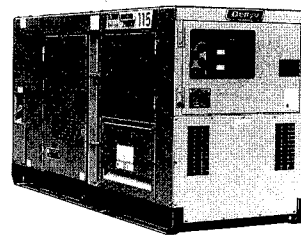
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97-10-007-06

Soundproof Type Diesel Engine Generator

Denyo Co., Ltd. has developed and started shipping out an ultralow-noise generator DCA-115 SPK mounting a clean type diesel engine which reduces the generation of nitrogen oxides and hydrocarbons considerably.

The new soundproof generator is based on a unique soundproofing design that reduces the noise to the level of 65.9 dB (A), and the company is presently applying for recognition as an ultralow-noise construction machine to the Ministry of Construction. The new generator has been designed compact and lightweight, with an output of 100-115 kVA, and has about the same size and mass of the company's 95-110 kVA type. The size is (L)2.9 × (W) 1.05



Ultralow-noise generator DCA-115 SPK

× (H) 1.45 m, and weight is 2,020 kg. It is sold at a domestic price of ¥5,200,000.

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Environment

97-10-008-01

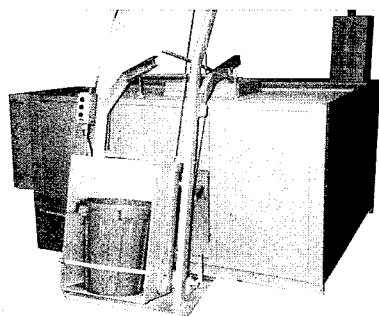
Garbage Composting System Halves Fermentation Treatment Time

Environmental Industry Laboratory Co., Ltd. has developed a garbage composting system YT Composter that halves the fermentation treatment time by creating a state that promotes microorganism activity by depressurizing the inside of the fermentation tank. Depressurizing lowers the boiling point to less than 70 °C to promote fermentation, while the water content of the garbage is vaporized.

YT Composter consists of a fermentation treatment tank for accommodating the garbage and about 20 heating pipes which enclose the tank. The incombustible oil filled inside these pipes is heated to about 120 °C with a kerosene boiler or an electric heater. The oil, after being heated, retains its temperature for several hours, so permits fuel conservation of over 30% compared with conventional counterparts not using any oil.

The pipe heat is transmitted to the fermentation treatment tank, and the tank temperature normally raised to over 100 °C, but the atmospheric pressure inside the tank is lowered with the ancillary depressurizing system, so the tank is maintained at 60-70 °C that is ideal for promoting microbe activity. The treatment time differs with the tank capacity, but is within 6-12 hrs, which is one-half compared with conventional counterpart tanks.

YT Composter is operated in three stages. In the fermentation-decomposition stage, the garbage is poured into the system composting vessel and the vessel is heated up to 60 °C. In addition to eliminating excess moisture in the form of vapor, this heating stimulates the aerobic microorganisms which are naturally present in all organic wastes to full activity. The resultant accelerated fermentation-decomposition treatment, combined with the churning of the rotary blades in the composting vessel, reduces the waste into a decomposed thick paste.



YT Composter

In the oxidation-decomposition stage, the temperature is increased and maintained at 100 °C. This temperature accelerates the natural oxidation process to further decompose bones and shells into a very brittle state, which the churning rotary blades will grind into fine powder. Simultaneously, this temperature will kill all microorganisms naturally present in all organic matter. However, thermophilic microorganisms which thrive at this high temperature will further decompose the organic matter into powder form.

In the sterilization-drying stage, the temperature is increased and maintained at 110 °C. This temperature kills off all remaining microorganisms, as well as any bugs or insect eggs. Simultaneously, the moisture content is reduced to about 10%, resulting in a fine, dry compost that is equivalent to 10-30% of the weight of the original garbage.

The system is marketed at a domestic price of ¥15 million to ¥700 million, depending on its specifications.

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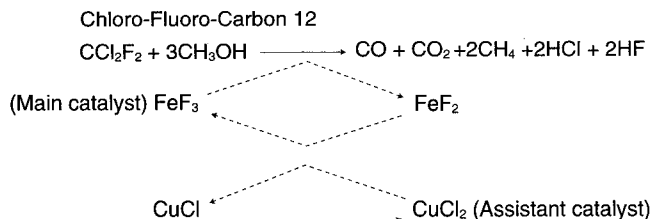
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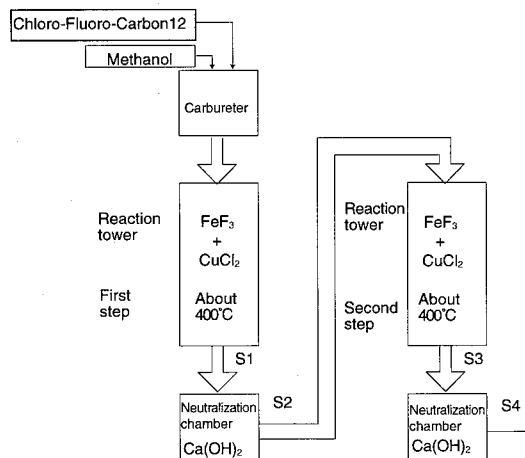
Technology for Low-Temperature Contact Decomposition of Chloro-Fluoro-Carbon Gas

Japan Science and Technology Corp. has developed a Chloro-Fluoro-Carbon Gas Low-Temperature Contact Decomposition Technology.

With this new technology, the Chloro-Fluoro-Carbon gas to be decomposed, such as Chloro-Fluoro-Carbon 12 (CCl_2F_2) or Chloro-Fluoro-Carbon 113 ($\text{C}_2\text{Cl}_3\text{F}_3$), is



Decomposition reaction exsample of Chloro-Fluoro-Carbon12



Main decomposition product

(S1) : CH₃Cl, HCHO, HF, CO₂, CO, H₂O and undecomposed Chloro-Fluoro-Carbon 12, 13

(S2) : CH₃Cl, HCHO, CO, H₂O and undecomposed Choro-Fluoro-Carbon 12, 13

(S3) : CH₄, HF, CO₂, H₂O

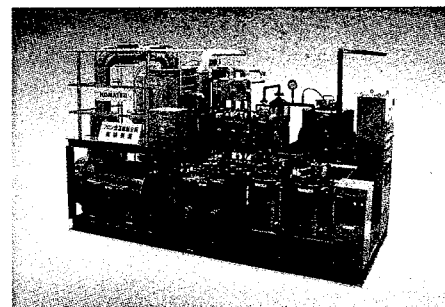
(S4) : CH₄, H₂O

Apparatus composition of new technology

mixed with methanol, heated and vaporized, then induced into a column (reaction tube) filled with a catalyst system that uses active carbon or porous alumina to support ferric fluoride as the main catalyst and cupric chloride as the assistant catalyst, by which the chloro-fluoro-carbon gas decomposition reaction is promoted. The generated hydrofluoric acid and other substances are neutralized with alkali, and the chloro-fluoro-carbon gas ultimately decomposed into methane and carbon monoxide.

This decomposition reaction is performed at about 400 °C. When used independently, ferric fluoride, the main catalyst, is gradually converted into ferrous fluoride with time and is deactivated, but is regenerated into ferric fluoride by the action of the assistant catalyst, so can retain its activity over a long period.

With this new technology, the catalysts (main and assistant) as well as the coreacting substance (methanol) are both inexpensive and available with ease, and since the decomposition reaction is an



Chloro-Fluoro-Carbon Gas Low-Temperature Contact Decomposition apparatus

exothermic reaction, only a small amount of heat needs be added, so the technology can be operated at a low cost.

The technology enables chloro-fluoro-carbon gas to be decomposed under comparatively gentle conditions (temperature of 400 °C), and the decomposition system scale and configuration can be designed freely depending on the necessary treatment volume and mode, so the system can be fabricated compact. Wide application is anticipated for the decomposition of chloro-fluoro-carbons and other gases.

*** Japan Science and Technology Corporation**

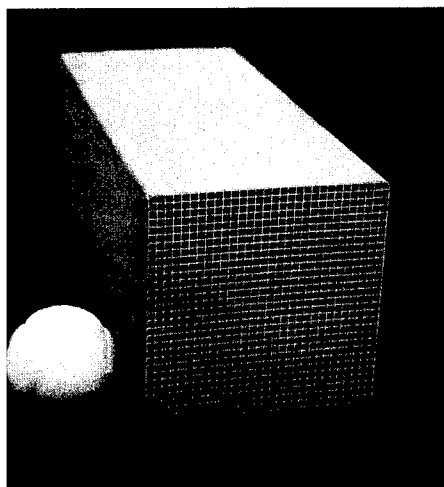
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97-10-008-03

Catalyst Decomposing and Removing 99% of Dioxin

Nippon Shokubai Co., Ltd. has developed a catalyst that can decompose and remove 99% of the dioxin in the exhaust gas from municipal refuse incineration furnaces.

The new honeycomb catalyst is manufactured with several types of metal oxides. It is installed in an optional position along the exhaust gas route of incineration furnaces, and the dioxin in the gas undergoes chemical reaction on the catalyst, by which the dioxin is decomposed into hydrochloric acid and carbon dioxide at an efficiency as high as 99%. The catalyst is usable in newly installed furnaces as well as existing furnaces, and by injecting ammonia gas into the exhaust gas, nitrogen oxides (NOx) can be removed at the same time.



New honeycomb catalyst

The generic method of treating dioxin in exhaust gas is to adsorb and remove it with activated carbon, but with this method, a substantial cost is incurred for after-treatment of used adsorbent. The new catalyst decomposes and renders dioxin harmless, which eliminates the need for after-treatment. The catalyst has a service life expectancy of about two years.

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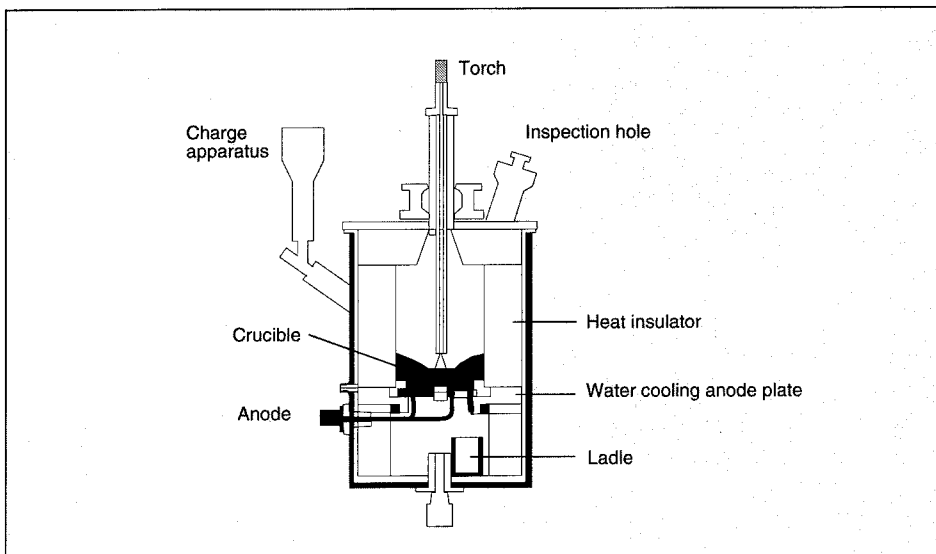
97-10-008-04

Manufacture of Refractory Bricks and Fireproof Structural Members Using Aluminum Dross

Chubu Electric Power Co., Inc. has developed the first recycling technology in Japan to manufacture refractory bricks and fireproof structural members by recovering and recycling aluminum dross that is generated as industrial waste in the processes of aluminum melting and refining as well as rolling.

tinuously charged from a feeder into the furnace and treated inside the carbon crucible installed at the chamber bottom. The purity of the alumina contained in the residue was improved to 90-97%.

The aluminum dross after plasma treatment can be possible to processed into refractory bricks, alumina wool and other fireproof material, and into structural materials such as glass wool. Alumina, a ceramic material, is expensive for use as a construction material, but by using aluminum dross containing more than 90% of alumina, excellent structural members are manufactured which feature a fire resistance unattained previously. Refractory bricks mixed with treated dross of 30% into the raw materials, were used for lining the



Plasma melting furnace

The aluminum dross waste (or residue) generated in the process of aluminum refining contains nitrides and heavy metals which exert adverse influences on the natural environment. The main component of the residue is aluminum oxide (or alumina) with a high melting point of 2,050 °C, so temperatures as high as 1,800-2000 °C are necessary to melt the residue. Therefore, the arc plasma heating technique enabling the generation of temperatures of up to about 10,000 °C is utilized to melt and render residue harmless.

Rated output of the melting furnace was 60 kW and a DC transfer type argon plasma was used. The chamber was maintained at air ambient atmosphere and atmospheric pressure. The residue was con-

tinues of incinerator and blast furnaces, and confirmed to feature almost the same properties and strengths as those of present refractory bricks.

When products are manufactured with aluminum dross, the prices of these products will be comparatively high, but if the cost for treating aluminum dross that is presently about ¥30,000/t increases to about ¥50,000/t, it will become possible to manufacture refractory bricks at competitive prices.

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Biotechnology & Medical Science

97-10-009-01

Sausage Containing Gamma-Linolenic Acid Alleviates Atopic Dermatitis

Prof. M. Takigawa of Hamamatsu Medical Science University has confirmed that gamma-linolenic acid, a metabolic substance of linoleic acid, is effective for alleviating the symptoms of atopic dermatitis. According to Prof. Takigawa's report, Nippon Meat Packers; The Apilight Sausage with added borage oil containing a large amount of gamma-linolenic acid improved the symptoms of 65% of patients with atopic-dermatitis.

It has been reported recently that gamma linolenic acid is effective for alleviating atopic dermatitis symptoms. The general methods for treating atopic dermatitis are oral and external treatments in parallel with guidance on eating habits. Milk, chicken eggs and soybean are well known as the three main allergens, and the food treatment method of eliminating these foods is highly effective especially for infants. However, with these infants in their growth period, it will be necessary to supplement nutrition deficiency by using alternative foods, for which meat is an excellent source of proteins, and the development of atopic dermatitis symptoms is low

among infants in food load tests based on the double blind method.

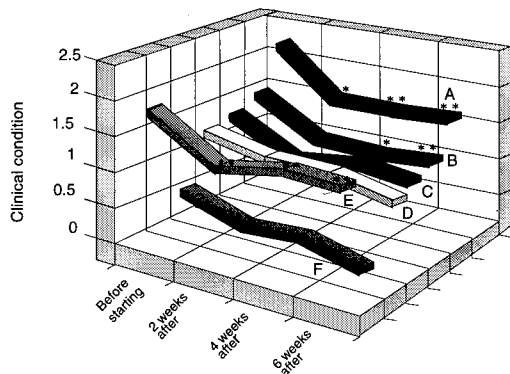
The sausage used as the test food serves as a valuable protein source when enforcing the food elimination method, and four meats, pork, turkey, lamb and rabbit are used, which are considered effective in the diversified, small-quantity assimilation method (rotational eating) of eating several types of foods in rotation.

The sausage used in the clinical tests contained 450 mg of borage oil (made by Japan Roche and equivalent to 90 mg of gamma-linolenic acid). The experiments were continued for eight weeks in parallel with ordinary treatments except during treatment with steroids by injection or very strong external use of steroid agents, or terminated when alleviation of the symptoms were obviously confirmed.

The symptoms of the patients were improved, in all cases using drugs in combination. Itchiness was decreased (23%), red spots were decreased (25%), and dry skin became moist (27%), so 65% of the patients or their parents confirmed that the test food was effective. The conditions of about one-half of the atopic dermatitis patients are improved with ordinary treatment so the sausage containing gamma-linolenic acid may be effective for about 20% of patients.



A: Itchiness
B: Red spots
C: Swelling
D: Drying
E: Desquamation
F: Vesicant



Atopic dermatitis clinical improvement after eating Apilight

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97-10-009-02

Marine Bacterial Enzyme Produces Oligosaccharide from Chitin

A research team made up of researchers from the Osaka National Research Institute and the National Institute of Bioscience and Human Technology, both belonging to the Agency of Industrial Science and Technology, has confirmed that enzymes produced by psychrotrophic marine bacteria produce oligosaccharides from various types of chitin contained in crab and shrimp shells.

These marine bacteria were obtained from the Japan Trench (sea depth 0-6,000 m) and from the Mariana Trough (sea depth 4,000-5,000 m). The bacterium from Japan Trench is a *Vibrio* sp., and the bacterium from Mariana Trough is a *Alteromonas* sp. It is conceived that these bacteria have a GlcNAC metabolic system in the same manner as marine bacterium *V. cholerae*, whose metabolic system was clarified by the system.

When the conditions for producing oligosaccharide from chitin were investigated, it was found that enzymes of both species of bacteria are active at 4-60 °C, and are highly resistant to temperature changes. Their activities were the most intense at about 50 °C, and these activities are not deteriorated even in neutral and weak alkaline waters.

These enzymes, despite originating from psychrotrophic bacteria, are active even at relatively high temperatures. A bright outlook has been acquired to establish a technique to produce oligosaccharide from chitin not with the usual chemical synthesis process but with a process using these bacteria. Previously, chitin was immersed in an alkaline solution, then thermally treated with concentrated hydrochloric acid, but the high cost of this process had been problematical.

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FLASH

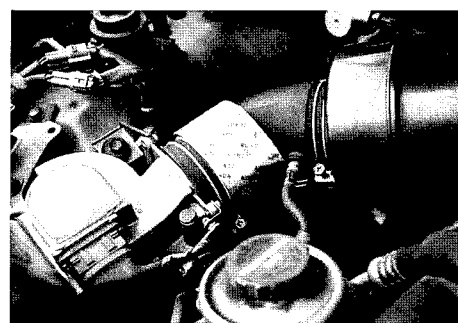
Magnetic Band Decreases Pollutants in Exhaust Gases

IONON Co., Ltd. has developed a magnetic band that improves the combustion efficiencies of automobile engines and decreases the pollutants in exhaust gases. Winding the magnetic band on the air intake inlet refines the oxygen molecules by magnetic action, so that the fuel in the engine is made easier to ignite and incomplete combustion is prevented.

The magnetic band can decrease the emission of nitrogen oxides, black smoke and carbon monoxide by 30-70% caused by ignition delay, and decrease the generation of carbon dioxide, so decreasing the fuel consumption by 10-30%. Fitting this band decreases the emission of toxic substances contained in the black smoke

and the carbon monoxide in the exhaust gas throughout the year in all types of vehicles including gasoline and diesel automobiles as well as trucks and buses, regardless of the model. In addition, the engine power is improved by 5-10%, and the emission of carbon dioxide, or the consumption of running fuel, is decreased substantially as corroborated through vehicle running tests.

The magnetic band Ninja is made of materials consisting of a mixture of ceramic powder and magnetic iron particles, and machined into belt form with a length of 8-60 cm. A weak magnetic field is caused from the band, which excites and disperses the oxygen molecules into



Magnetic band Ninja

ultrafine particles and improves the engine's ignition performance.

The magnetic band for motorcycles and light automobiles is marketed at a domestic price of ¥5,800, that for gasoline automobiles at ¥12,000, and that for large buses and trucks at ¥350,000.

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High-Accuracy Light-powered Quartz Wristwatch Series

CITIZEN Watch Co., Ltd. has developed a light-powered quartz high-accuracy movement (drive mechanism) featuring an annual error of within ± 10 seconds, and will be marketing 11 models of the Exceed series high-class wristwatches including this movement.

The new wristwatch models for men feature a high accuracy with an annual error of within ± 10 seconds for the first time with a timepiece requiring no battery change and incorporating a light-powered Eco-Drive (ecologically driven) mechanism that, fully charged, can be driven for about 5 months. The mechanism features the world's highest accuracy with a quartz timepiece requiring no battery replacement.

Ordinary no battery-replacement type quartz movements have a monthly error

of (within) about 10 seconds, and even the most accurate movements have an annual error of within 5 seconds. Quartz movements requiring no battery change have to be recharged, which generates changes in the voltage, so that the error is larger than that of the battery changing type. The new movement uses a circuit that maintains the voltage on a fixed level, which minimizes the error.

The new mechanism is driven with light, a clean type of energy, and the Eco-Drive that does not generate waste battery is designed on the company's concept of producing products which do not involve any energy or environmental disruption or problem.

The new Exceed series wristwatches include eight models for men and three models for women. These timepieces have



Exceed

cases which are made of fine titanium alloy appearing like stainless steel or hard fine titanium that is harder than Fine Titanium alloy. They are priced between ¥50,000 and ¥100,000.

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